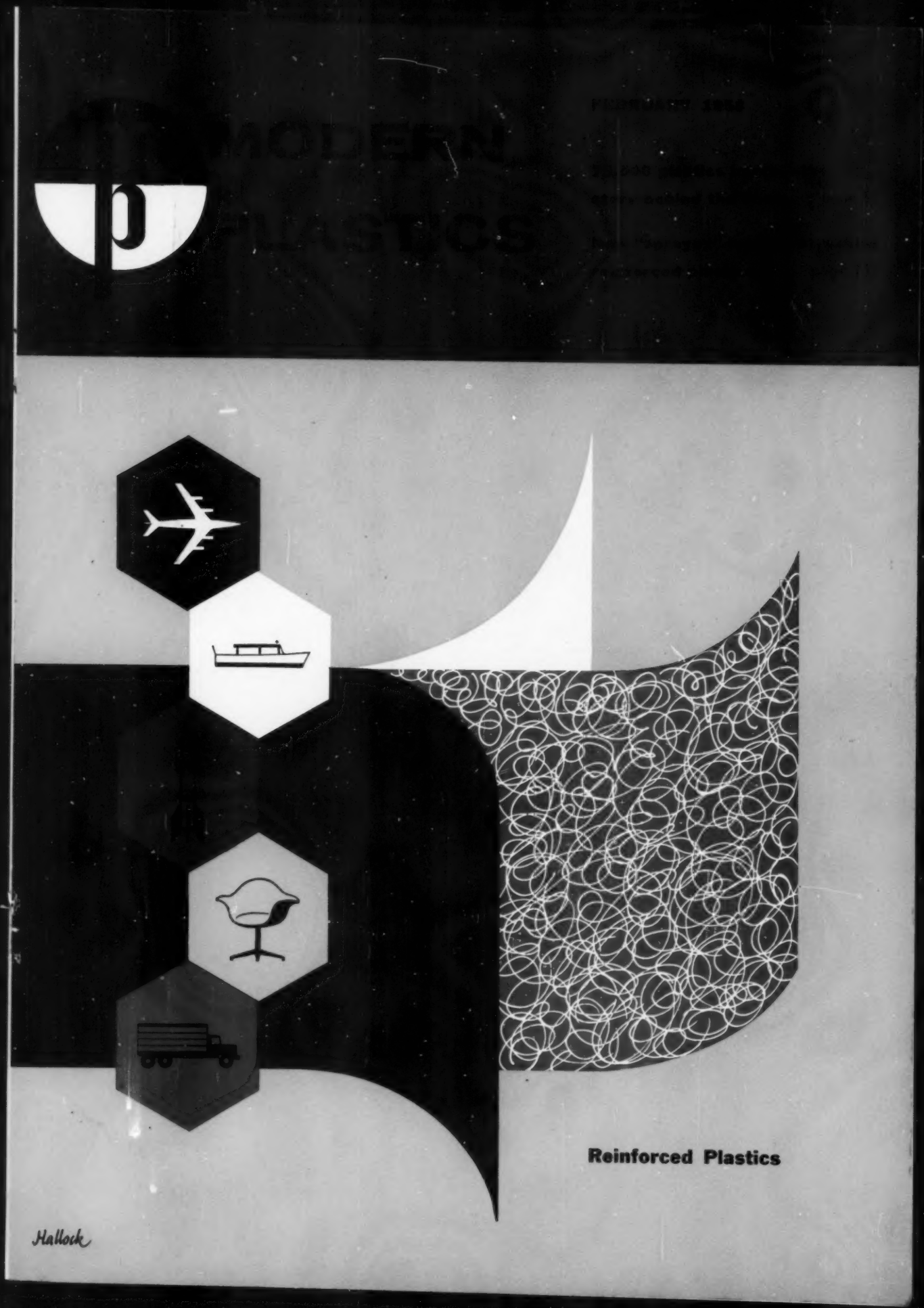

Reinforced Plastics
Hallock



Where do you need high impact strength at low cost? These nuggets of sisal-filled Durez 18683—black or natural—can give it to you.

New! Low-price phenolic molds high-impact parts

Now, for the first time ever, you can mold high-impact phenolic parts *with a low-priced material*—Durez sisal-filled 18683!

Costing only pennies more than wood-flour-filled compounds, Durez 18683 gives you dimensionally stable parts that have an impact strength of 1.4 ft. lb./in.—and give excellent results in high humidity tests.

Use standard equipment

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Where else can you use 18683?

Consider it, too, for "wet inside—dry outside" conditions; for high-strength jobs in automotive heater housings, glove compartments, dashboards; for gears and wheels, instrument housings, terminal connectors, electric motor end bells—wherever you need impact strength and want it at lower cost.

Don't freeze the cost of your high-impact parts until you've seen what 18683 can do for you. To get an evaluation sample and prices, write today on your business letterhead.

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PLASTICS DIVISION

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Catalin STYRENE...the gem of plastics

Pearls, since antiquity, have remained among the most sought after, most flattering feminine adornments. Methods and materials to rival the oyster's finest creation have long engaged the efforts of chemists and craftsmen.

Glass, translucent minerals and — more recently — extruded plastics were turned into beads as the base material for pearlescent coatings. CATALIN STYRENE seemed an ideal low-cost material . . . its crystal clarity could contribute improved internal luminosity; its light weight could add to wearing comfort. However, suitable finishes for styrene's non-absorptive surface were unavailable.

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In many and ever-widening fields of manufacture, because of its sturdiness, handsomeness and moldability, CATALIN STYRENE is proving itself *the gem of plastics*. Your production problems may indicate that you have a promising setting for its use. Inquiries invited.

*Tell Manufacturing Company, Inc., Orange, N. J.

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MODERN PLASTICS*

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February
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Number 6

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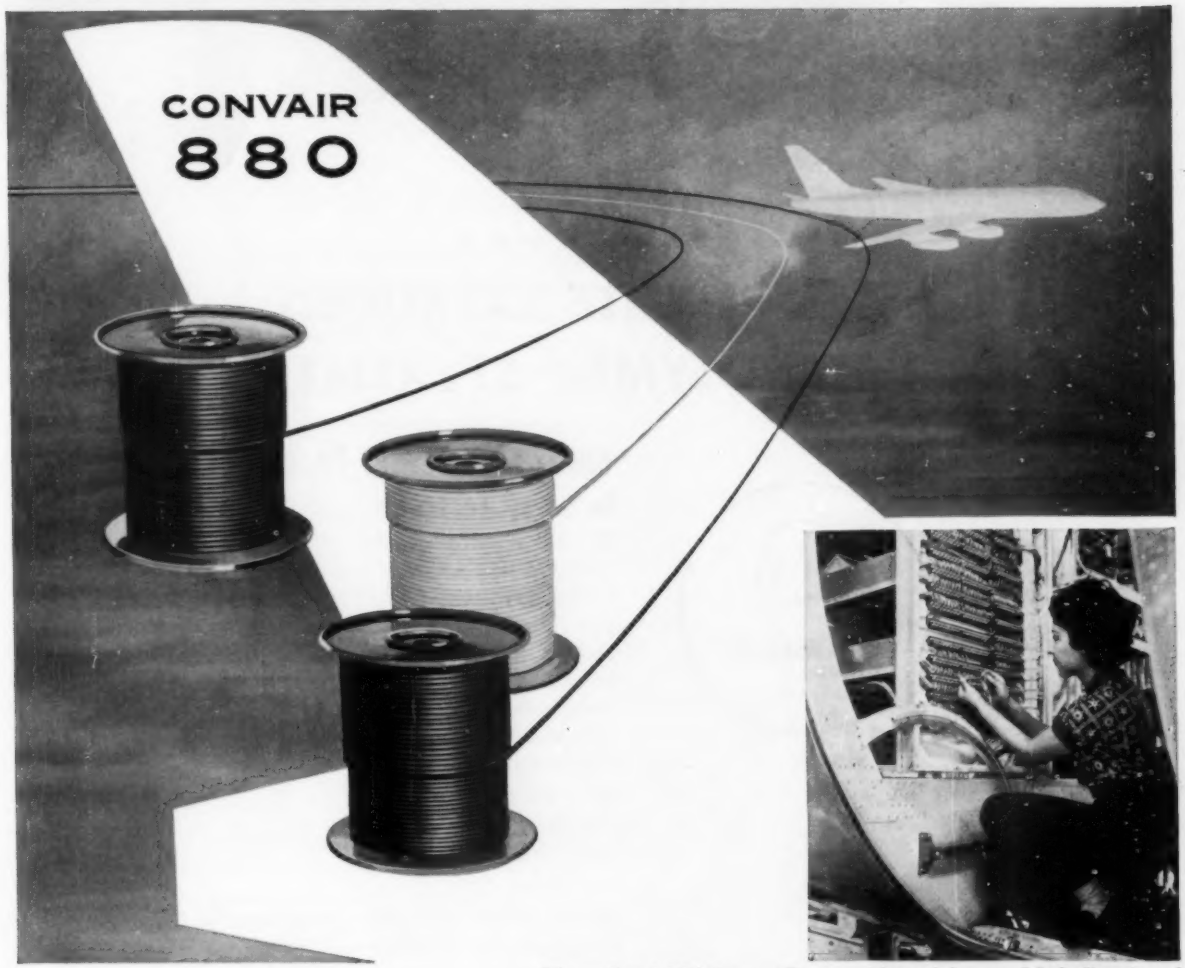
276 Index to Advertisers

Modern Plastics Executive and Editorial Offices: 575 Madison Avenue, New York 22, N.Y.

Modern Plastics published monthly by Breskin Publications, Inc., at Emmett St., Bristol, Conn. Modern Plastics Encyclopedia Issue published as second issue in September by Plastics Catalogue Corp., at Emmett St., Bristol, Conn. Second-class mail privileges authorized at Bristol, Conn. Subscription rates (including Modern Plastics Encyclopedia Issue), payable in U.S. currency: In United States, its possessions, and Canada, 1 year $7, 2 years $12, 3 years $17; all other countries, 1 year $20, 2 years $35, 3 years $50. Single copies 75¢ each (Show issue, $1.00; Encyclopedia issue, $3.00) in the U.S., its possessions, and Canada; all other countries $2.00 (Show issue, $2.50; Encyclopedia issue $6.00). *Reg. U.S. Pat. Off

Another new development using

B.F.Goodrich Chemical *raw materials*



The new Convair 880 jet passenger liner uses wiring made by many of the leading wire and cable companies. B.F.Goodrich Chemical Company supplies the Geon polyvinyl material only.

15 MILES OF GEON HELP JET-LINER BEAT THE HEAT

MOVING East to West just a step behind the sun, this new jet passenger liner will make it from New York to Los Angeles in 4 hours 32 minutes. Hard at work inside this plane of tomorrow will be wire whose 15 miles of tough insulation is made of a unique new Geon polyvinyl compound.

Why Geon Was Chosen—Geon 8800 compound has 5 *times* the insulation resistance of previously available insulations over the full operating temperature range. The exceptional heat stability of Geon 8800 provides the superior performance required for jet aircraft wiring. These properties offer advantages as well for appliances, computers, machine wiring and similar applications.

How We Can Help You—Versatile Geon polyvinyl materials, in addition to providing flexible electrical insulation, are used for rigid piping and valves, protective coatings for steel, paper, upholstery. B.F.Goodrich Chemical supplies hundreds of types of resins, plastics, latices, and polyblends tailored to specific uses.

For information on applications write Dept. LE-2, B.F.Goodrich Chemical Company, 3135 Euclid Ave., Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.



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Now...
CAMPCOLITE EXTRUDED TRIPOLYMER STYRENE

New tripolymer (A.B.S.) sheet is easy to form...

The first proven *extruded* tripolymer styrene sheet, named Campcolite, is now available commercially in a variety of colors, finishes and textures. Characterized by unusual physical strength and chemical inertness, Campcolite is far superior for vacuum-forming than other tripolymer styrenes that are calendered or laminated. The extruded sheet has a very high impact strength and when vacuum formed is stronger and has better color control. Extrusion also makes it economical to obtain custom size sheet. Other properties are:

LIGHT WEIGHT of Campcolite cuts shipping costs, eases handling. This new tripolymer is 13% of the weight of steel, only 39% as heavy as aluminum.

Yet it has . . .

HIGHER IMPACT STRENGTH — many times the impact strength of other sheet. Exceptionally thin sections can be used. (And you can even bend a section 180° without failure.)

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In addition, Campcolite offers exceptional surface hardness, a relatively high heat distortion point, superior flexural strength and a low brittle point. (It even remains tough at —40°F.) Its versatility is underscored by the ease with which it can be machined, sawed, milled, drilled, sheared, blanked or punched. It can also be riveted, nailed, stapled or cemented.

Thus, Campcolite is ideal for scores of applications where vacuum formed plastics have not been practical until now. For example, everything from contour chairs to bicycle seats . . . from helmets to suitcases . . . from tote boxes to camera cases.

Write today for free list of suggested applications, along with complete technical data.

CAMPCO *sheet and film*

a division of **Chicago Molded Products Corp.**
2721 Normandy Avenue, Chicago 35, Illinois

Editorial

Processor participation #2

In May, 1957, we published an editorial under the title "Processor participation," pointing out the need for more conference and convention platform participation on the part of plastics processors—molders, extruders, fabricators, laminators, etc.

From that editorial we quote: ". . . processors are constantly complaining about 'platform selling' on the part of material makers, and . . . a vast amount of engineering knowledge and ability rests in the engineering departments of the molders, extruders, and other processors."

Whether or not our diatribe brought about the needed reformation is beside the point. The fact is that in the case of two important conferences in January and February 1958, the desired reformation has been accomplished with vigor.

Here are the comparisons: At the 1957 S.P.E. Conference material makers sponsored 61% of all the events, processors and fabricators 11%, machinery and equipment makers 9%, consulting and educational organizations 12%, and end-users' laboratories 7%.

But at the 1958 S.P.E. Conference, material makers are sponsoring only 53% of the events, end users (including captive processing plants) 15%, machinery and equipment makers 14%, consulting and educational organizations 11%, and custom processors and fabricators 7%.

At the 1957 Conference of the Reinforced Plastics Div. of S.P.I., material makers presented 33% of the papers, processors 28%, military and government facilities 30%, while the remaining 9% was made up of papers from consultants, end-users' laboratories, etc.

Now, at the 1958 S.P.I. Reinforced Plastics Conference, material makers will present only 23% of the papers, military and government sources 12.2%, machinery makers 4%, processors (custom and proprietary, including aircraft) 37.8%, universities, laboratories, and consultants 23%.

To all concerned, and particularly to the program committees, our heartiest congratulations.

It is noted that not only are the custom processors increasing their contributions, but that a vigorous new stream of know-how is coming from the increasing number of captive processing plants. We hope and trust that future conferences will have on their agendas an even higher percentage of participation by processors.

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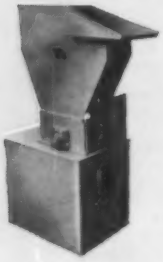
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What grinding capacity do you need?

200 POUNDS AN HOUR



M-100

20" x 27" floor area
8" x 8" throat
hopper tray height: 49"
1½ HP motor

300 POUNDS AN HOUR



M-200

24" x 27" floor area
8" x 12" throat
hopper tray height: 49"
3 or 5 HP motor

400 POUNDS AN HOUR



M-300

30" x 31" floor area
8" x 16" throat
hopper tray height: 51¾"
7½ or 10 HP motor

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Lowest price for the performance! **Compare B & J Marvel Series Granulators with any other grinders on the market, and, you'll see what we mean. Dollar for dollar, you'll agree that your best buy is a B & J Granulator.**

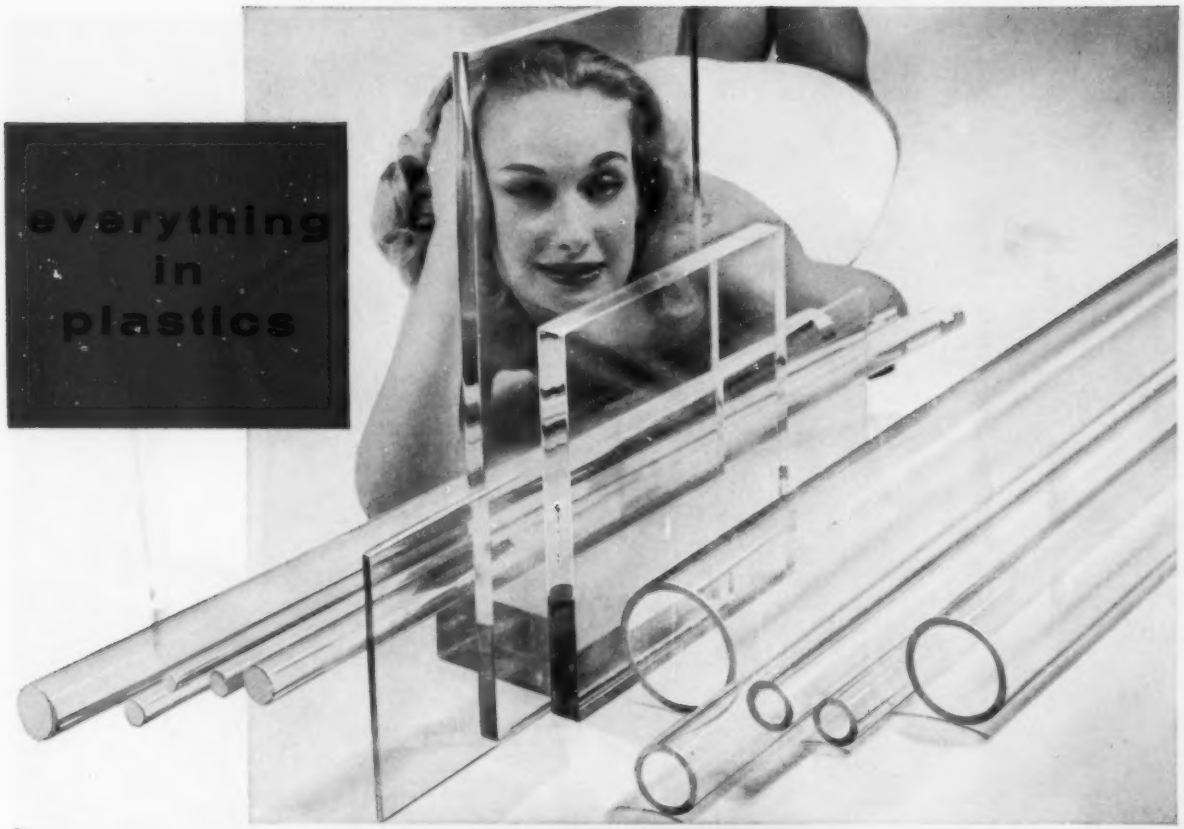
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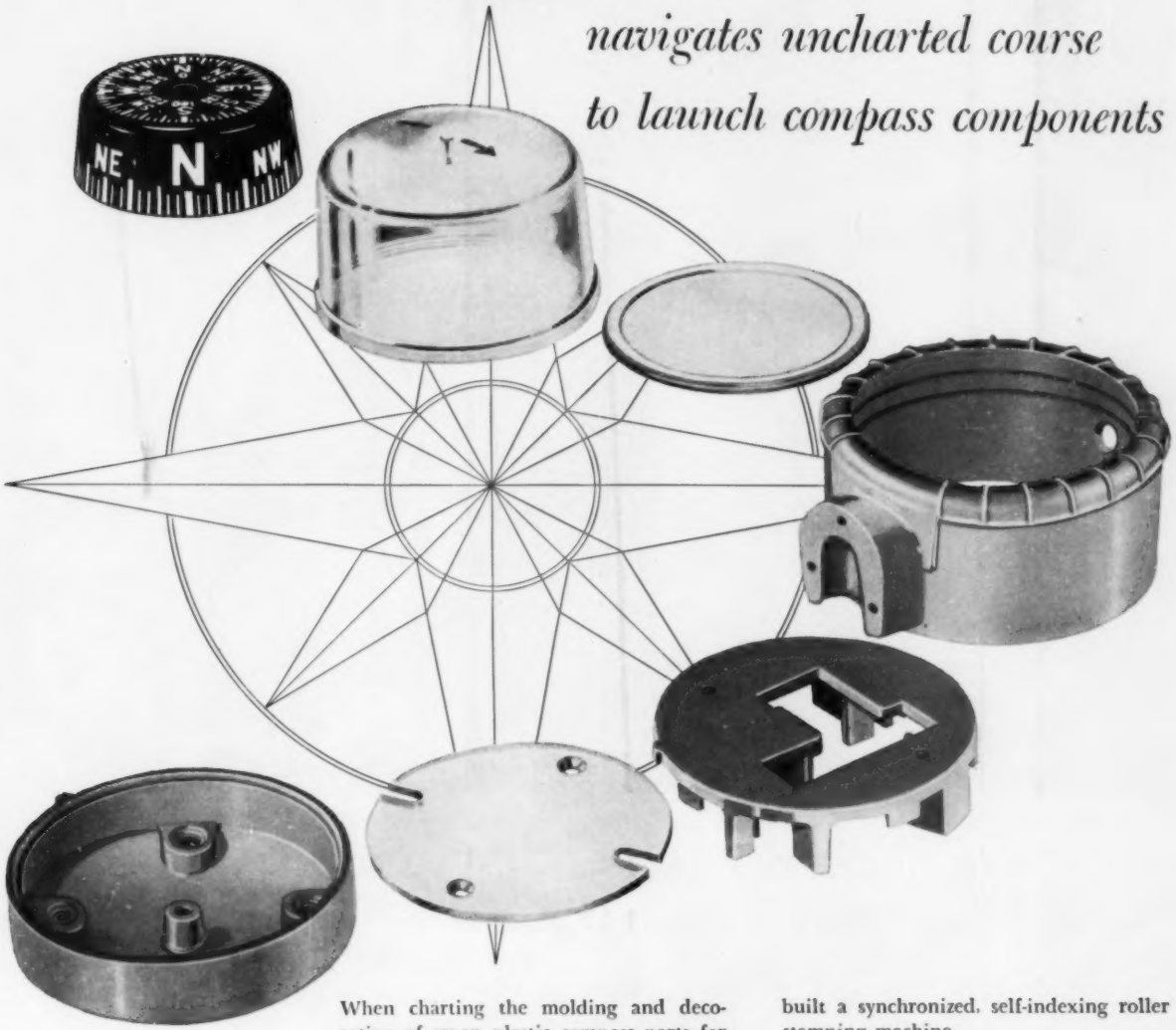
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NOSCO "CAN DO"

navigates uncharted course
to launch compass components



When charting the molding and decorating of seven plastic compass parts for Taylor Instrument Companies, Nosco "Can Do" recognized the hidden danger threatened by the lettered "compass card." This card is cone-frustrum shaped and it's no simple matter to line up the peripheral lettering around the side surface with the conventional flat hot stamping on the top. The card was molded in a multiple cavity die and each cavity had to be sized perfectly so that all parts would be exactly alike . . . else the lettering would be off. To apply the peripheral lettering consistently and correctly, Nosco designed and built a synchronized, self-indexing roller stamping machine.

The other compass parts were molded in two combination molds handling three items each—cutting down both tooling and molding costs. Nosco also annealed the two thin-walled plates and provided a mirror finish on the crystal-clear acrylic dome. The result? A compass that's true.

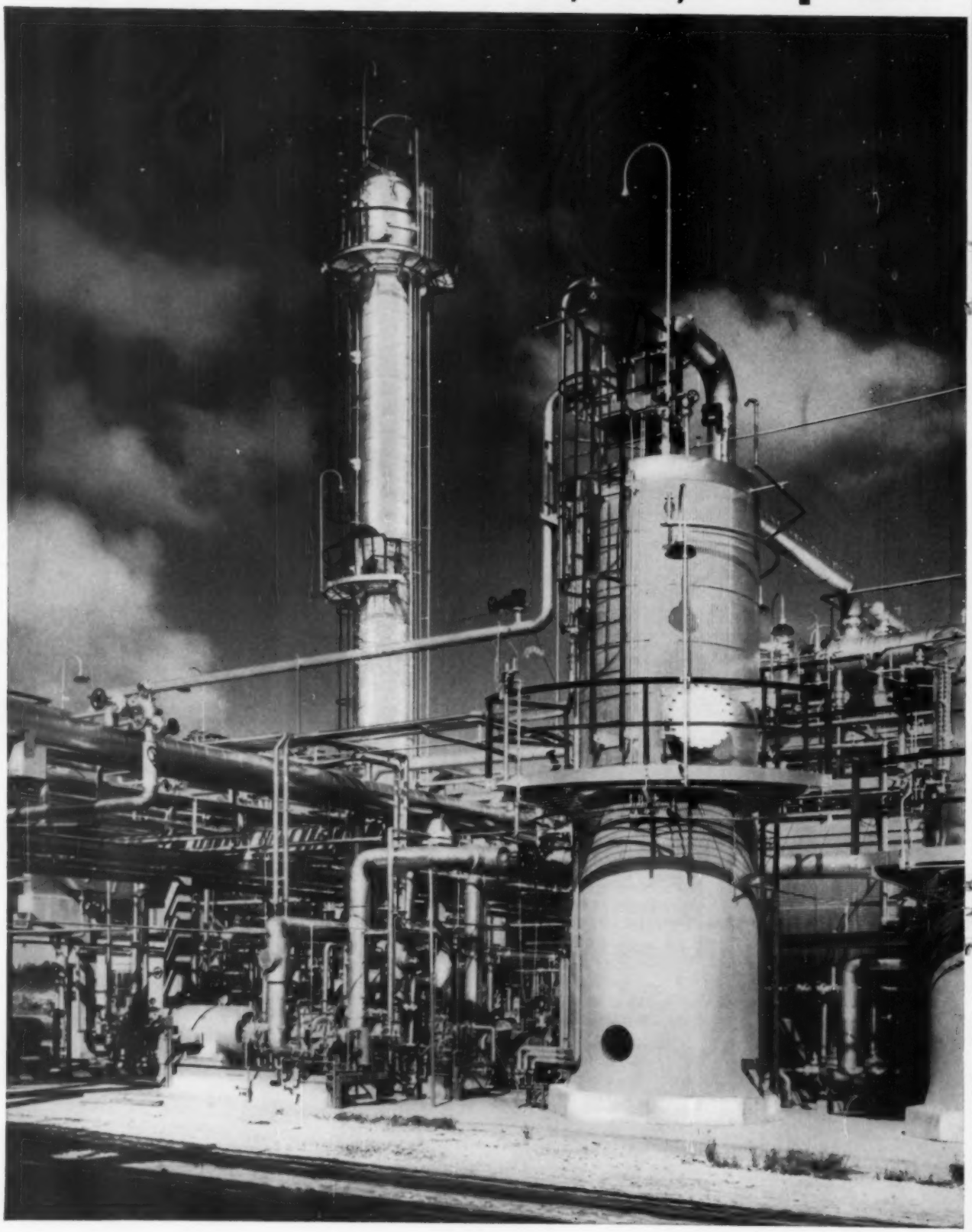
Why not try Nosco "Can Do" on your next plastic part? Let one of our sales-engineers advise your buyers and designers how Nosco "Can Do" can produce your needs in practical plastics. Just write.



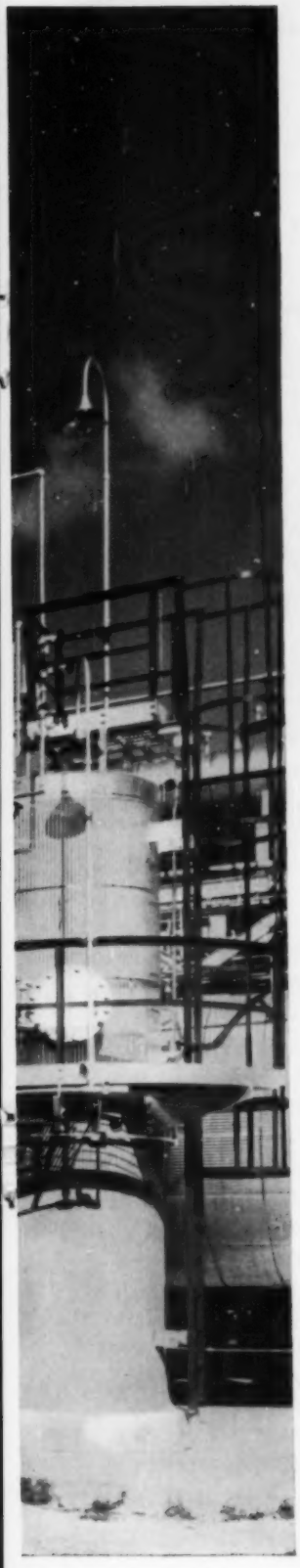
For other case histories—and for a glimpse of the Nosco plant and facilities, send for the free 12-page brochure, "How the Nosco Plant Works to Produce Your Needs in Practical Plastics."

NOSCO plastics, inc. • erie 4, pa. *World's largest injection molding plant*

W. R. Grace & Co.'s 50,000,000 pound



high density polyethylene plant now in commercial production



* Multi-million dollar facility to produce GREX, the new high strength plastic resin.

* W. R. Grace & Co., Polymer Chemicals Division, reports GREX substantially improved over other resins, promising new horizons for plastics.

W. R. Grace & Co., Polymer Chemicals Division, recently put into commercial operation its multi-million dollar plant at Baton Rouge, Louisiana. First product is GREX, brand-new high density polyethylene. 50,000,000 pound annual capacity makes this the world's largest plant of its kind to come on stream as an integrated operating unit.

For several months, plastic fabricators have been testing and evaluating quantities of GREX with excellent results. Now, with this new plant, GREX is immediately available for large-scale commercial application.

"NEW CHEMICAL PRODUCT"

Officials of W. R. Grace & Co. express enthusiasm over the possibilities GREX offers the plastics industry, characterizing GREX as "plastic of tomorrow" and "new concept in plastics." According to Mr. T. T. Miller, Polymer President, "GREX differs from other plastics to such a degree, it merits being called a new chemical product."

Exceptional toughness and resistance to extremes of heat and cold are the outstanding property improvements to be found in GREX. Resistance to chemicals, impermeability to moisture vapor, good electrical characteristics, and rigidity are other property areas in which GREX excels. This new material can be injection molded, extruded, compression molded, blow molded, calendered, vacuum formed and foamed. It can be machined, punched, drilled, welded and heat sealed.

VERSATILITY CITED

What does this mean to the plastics industry? "GREX," explains Mr. Miller, "gives the fabricator a quality resin with outstanding versatility. GREX permits him to convert ideas for completely new plastic products into selling items. And by switching to GREX, he can upgrade his present plastic products.

The Polymer Chemicals Division laboratories at Clifton, N. J. include a full line of commercial size plastic fabrication equipment for development purposes. Here, a trained and seasoned technical staff works with Grace customers to learn what plastic products can be better-made with GREX, to uncover new uses for plastics, and to discover more efficient fabrication techniques. The Grace technical staff have also proved their ability to help a customer in his own plant.

OFFER MARKETING SUPPORT

The makers of GREX extend this support to the marketing of GREX products as well. Grace merchandising experts will work with fabricators, and through them, with customers, to help search out their most promising markets. Then, Grace will collaborate on sales and promotion planning to achieve increased sales.

Mr. Miller emphasizes that GREX is expected to make substantial gains in markets now dominated by other materials like glass, wood, metal, offering the plastics industry unlimited potential. There is virtually no business that cannot put GREX to good use.

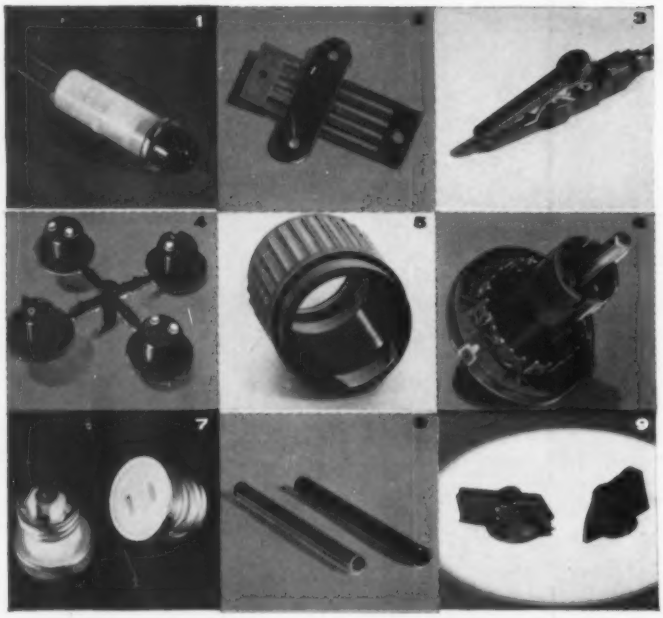
INQUIRIES INVITED

"GREX is a new product with great promise," he declares. "We believe in it to the tune of over $20 million. But more important, we at Grace are willing to work to prove out GREX in actual applications. Anyone interested in GREX has only to write or phone us at our Clifton offices—225 Allwood Road, Clifton, New Jersey, GRegory 2-6000. His inquiry will receive our immediate attention and he can be sure of full cooperation from our entire organization."

5 more examples



LETTER CAMS in IBM Electric Typewriter drive the type bar forward when typist touches key. In these accurate nylon-to-metal moldings, ZYTEL nylon resin reduces wear on roller, resists abrasion and impact. (Made by International Business Machine Corporation, New York, New York.)



COMPONENTS: (1) pilot light with body of ZYTEL and lens of Du Pont LUCITE® acrylic resin, (2) multiple-switch part, (3) alligator clip, (4) capacitor bases, (5) tripod leg lock, (6) switch assembly, (7) socket plug, (8) test prod sleeves, (9) bar knobs. (Molded of ZYTEL by Industrial Devices, Incorporated, Edgewater, New Jersey.)

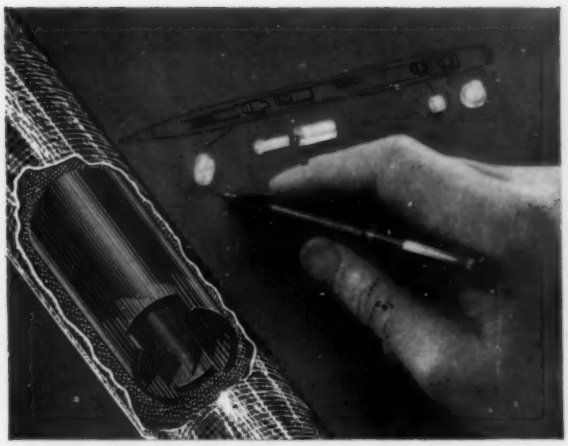
WHY is an ever-increasing variety of products, such as those shown here, being molded of ZYTEL nylon resin? Because ZYTEL offers designers a large selection of outstanding properties. It's easy to name a number of the major properties of ZYTEL, each of which could be decisive in assuring the success of a product:

- **ZYTEL CAN BE INJECTION-MOLDED**
- **FINISHING COSTS ARE MINIMUM**
- **EXCELLENT HEAT RESISTANCE**
- **VERY HIGH STRENGTH**
- **LIGHT IN WEIGHT**
- **COLORABLE**
- **UNAFFECTED BY MOST CHEMICALS**
- **LITTLE OR NO LUBRICATION NEEDED**
- **GOOD BEARING PROPERTIES**
- **HIGHLY SHOCK-RESISTANT**
- **OUTSTANDING ABRASION RESISTANCE**

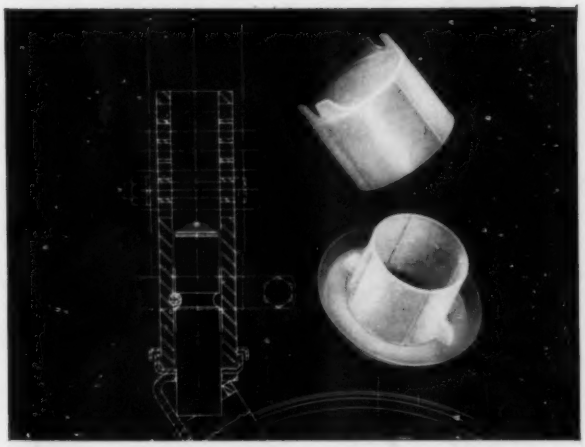
showing how Du Pont ZYTEL®

NYLON RESIN

makes new products possible . . . existing products better



PEN COMPONENTS molded of Du Pont ZYTEL nylon resin are held to minute tolerances. Parts of tough, wear-resistant ZYTEL help give pen long life. (Molded by Gries Reproducer Corporation, New Rochelle, New York, for The Esterbrook Pen Company, Camden, New Jersey.)



HEAVY-DUTY BUSHINGS of ZYTEL in wheel shaft of agricultural rake have high strength and wear resistance. Lower bushing also functions as thrust bearing and dust seal. (Rake manufactured by the Tractor and Implement Division of Ford Motor Company, Birmingham, Michigan.)

In the hardware industry, for example, parts traditionally made in brass are frequently replaced by ZYTEL. For one, the cost of ZYTEL per unit volume is approximately half that of the metal. ZYTEL has definite production advantages, such as the use of multicavity dies to produce a finished product. Any one of the other advantages listed above could make a real difference which would be spelled out in dollars and cents at the sales counter.

We'll be glad to send you all the technical information you need to give you a clear picture of the capabilities of ZYTEL for making your product better. Many end-use ideas are included. Simply send coupon at right.



BLACK "ZYTEL" NYLON RESIN is used to make this garden-hose coupler, which connects with simple push and twist. It survives shock of dropping or dragging over stone . . . cannot corrode. (Molded by The Ark, Inc., for Stile Craft Manufacturing Company, both of St. Louis, Missouri.)

DU PONT

REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

E. I. du Pont de Nemours & Co. (Inc.)
Polychemicals Department
Room 272, Du Pont Building, Wilmington 98, Del.

Please send me more information on Du Pont ZYTEL nylon resin. I am interested in evaluating this material for_____

*Name*_____

*Position*_____

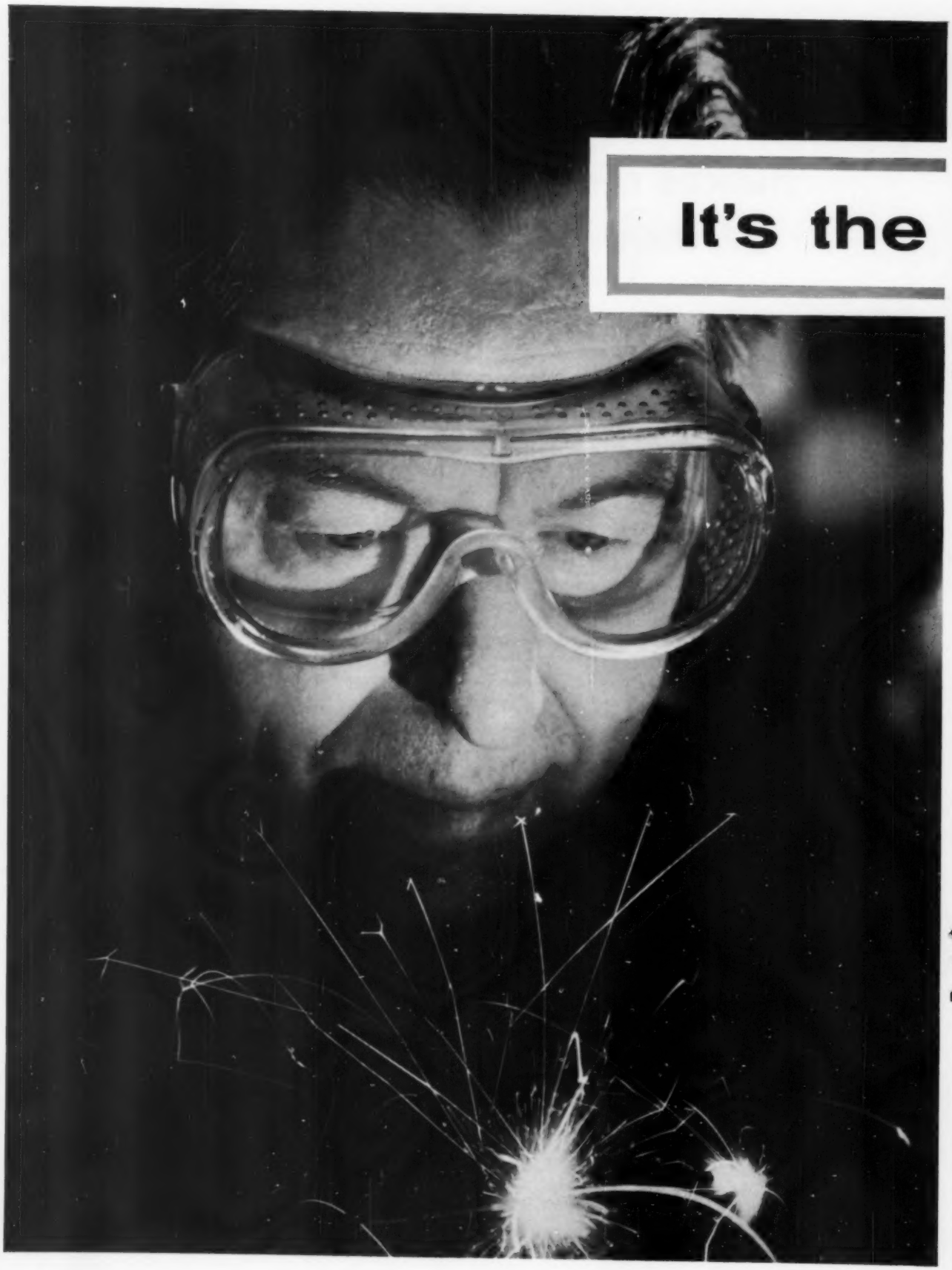
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In Canada: Du Pont Company of Canada (1956) Limited, P.O. Box 660, Montreal


It's the

optimum for opticals!

We think you'll find the optimum in both protection and comfort in the safety goggles pictured at left. And one big reason is their lightweight, transparent, flexible frame made of PLIOVIC S70.

PLIOVIC S70 is a recently introduced polyvinyl chloride resin with unique properties. It is used in the frame compound because of its exceptional clarity and ease of compounding and processing.

PLIOVIC S70 is made of fine uniform particles. The large surface area permits effective adsorption of all commercial plasticizers. In addition, heat and light stability is equivalent to that obtained in higher molecular weight resins.

The medium viscosity of PLIOVIC S70 also permits fast, homogeneous fluxing and maximum flow at relatively low temperatures. The end result is a readily injection-molded frame of excellent end properties, longer life and lower cost.

Injection-molded goggle frames are but one use for PLIOVIC S70. It also can be used to advantage in calendered or extruded applications where processing is critical or optical clarity is desired. Try it alone or in combination with other resins for greater utility of equipment or for a wider range of products from the same equipment.

Full details, including the latest *Tech Book Bulletins*, on PLIOVIC S70 and other members of the PLIOVIC family of tailor-made vinyls are yours for the asking. Just write to Goodyear, Chemical Division, Akron 16, Ohio.



CHEMICAL
GOODYEAR
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PLASTICS DEPARTMENT

CHEMIGUM • PLIOFLEX • PLIOLITE • PLIOVIC • WING-CHEMICALS

High Polymer Resins, Rubbers, Latices and Related Chemicals for the Process Industries

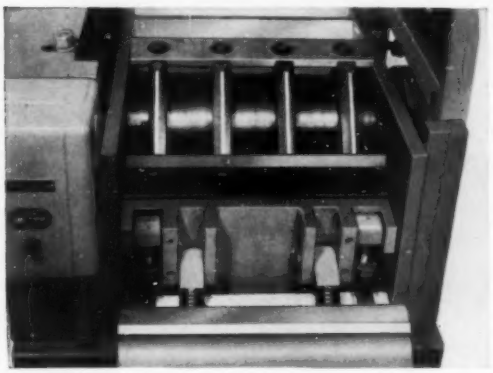
Chemigum, Pioflex, Pliolite, Pliovic —T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

60th GOODYEAR ANNIVERSARY

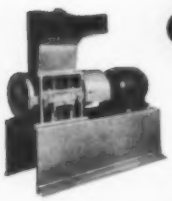
Photo courtesy American Optical Company, Southbridge, Mass.



TWO NEW Cumberland Beside The Press GRANULATING MACHINES

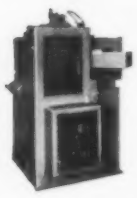


PART OF THE COMPLETE LINE OF CUMBERLAND PELLETIZERS, BESIDE THE PRESS AND CENTRAL GRANULATING MACHINES, DICERS, CHOPPERS AND PRE-BREAKERS



CENTRAL GRANULATING MACHINES

The Cumberland Model 20 shown left is one of a series of rugged, high quality central granulators offering a choice of throat openings and power.



STAIR STEP DICER

Produces perfect cubes or pellets 1/16" to 1". Two standard sizes accommodate up to 7" and up to 14" ribbons.

LARGE THROAT OPENINGS – 12" x 16" (Shown above). Companion machine has throat opening 8½"x12".

QUALITY CONSTRUCTED entirely of steel weldments. Advanced design leaves all working parts readily accessible for cleaning and adjustment of knives.

NEW PERFORMANCE – New knife design and slow rotor rpm provide better granulation and quiet operation. Clean cutting of the complete range of thermoplastic materials from softest polyethylene and vinyls to hard and tough nylon, Cycolac, and Kralastic.

MINIMUM FLOOR AREA – Model 12" x 16" requires only 26" x 26". Model 8½" x 12" requires only 22" x 24".

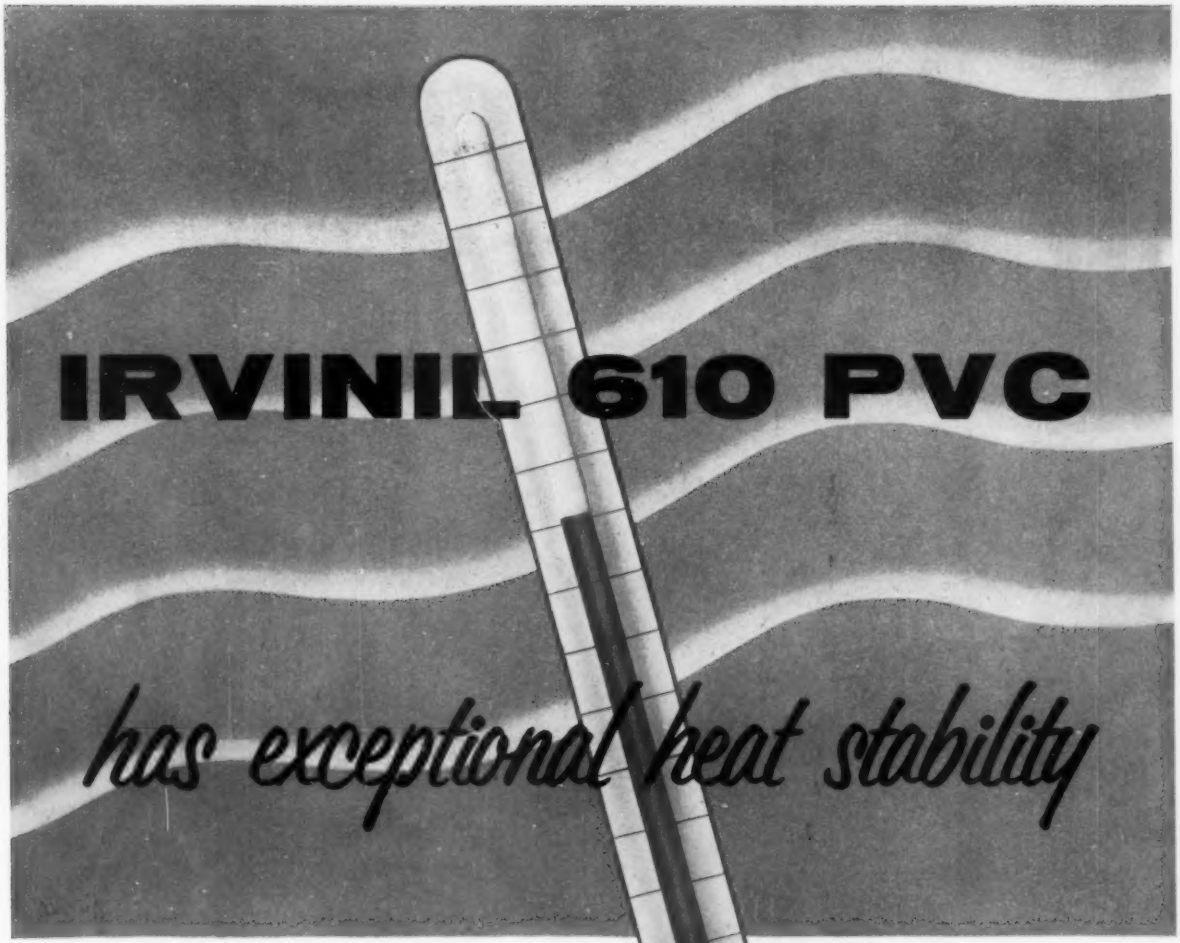
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ENGINEERING COMPANY, INC.

DEPT. 1 • BOX 216, PROVIDENCE, RHODE ISLAND

California Representative: West Coast Plastics Distributors, Inc. 8510 Warner Drive, Culver City, Calif.

FOREIGN LICENSEE—Burtonwood Engineering Company, Ltd., Burtonwood, Warrington, Lancashire, England—Sole Manufacturers and Distributors outside North and South America.



YES, IRVINIL 610 PVC, a general purpose high molecular weight polymer, has truly superior heat stability. But this is only one of Irvinil 610's outstanding compounding properties. Additionally, it offers you toughness, excellent light stability, extremely low "fisheye" content and superb dry blending properties.

Needless to say, you *know* how important these qualities are in dry blend extrusion, calendering and injection molding.

Remember, too, that Irvinil 610 makes processing easier and products better because of these other noteworthy unusual qualities: uniformity, excellent color retention, high bulk density, fine dielectric properties and inertness to water, dilute acids and alkalis.

Irvinil 620 PVC

A medium molecular weight resin, Irvinil 620 was developed especially for calendering applications requiring a *softer resin* than Irvinil 610. All the fine qualities of Irvinil 610 also hold true for this resin.

* * *

As part of its overall services, Great American Plastics creates special resins and special compounds designed to meet individual needs. Send today for complete data on our Irvinil Resins and full information on our friendly technical services. GREAT AMERICAN PLASTICS COMPANY, 650 Water Street, Fitchburg, Mass.

IRVINIL Resins

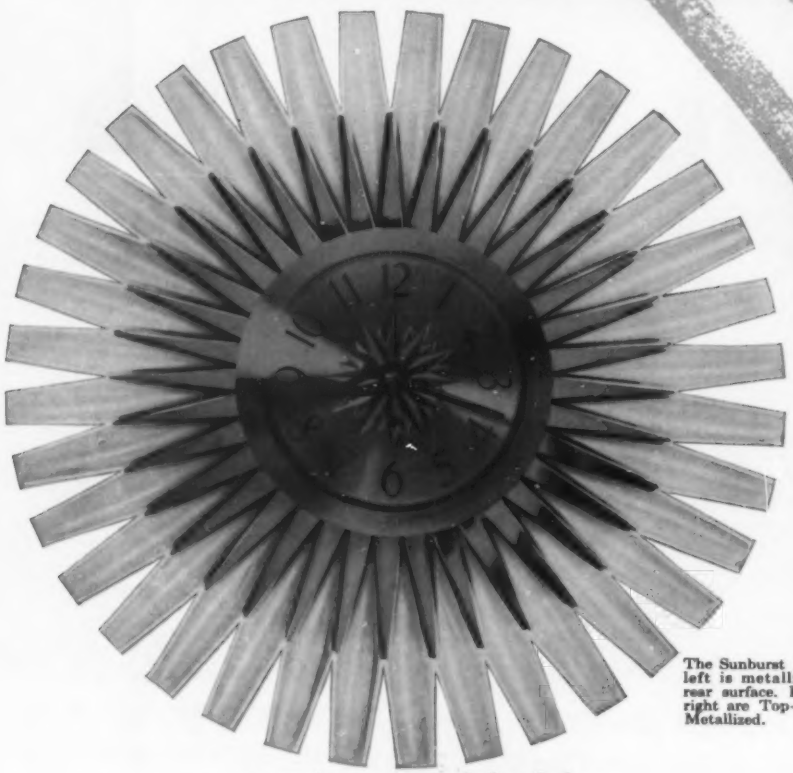
GREAT AMERICAN PLASTICS COMPANY

PACING PROGRESS IN PLASTICS SINCE 1922

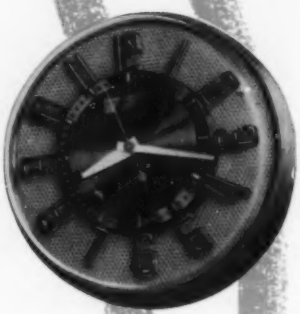


Time CAN BE BEAUTIFUL

. . . . when marked by these sparkling General Electric-Telechron Dials and Cases







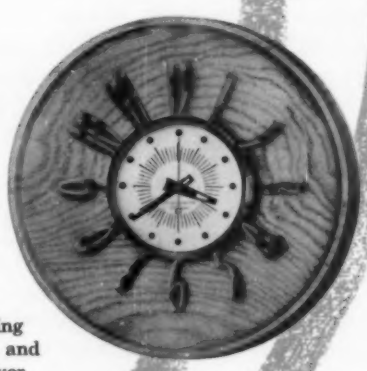
The Sunburst Case at left is metallized on rear surface. Parts at right are Top-Surface Metallized.

custom molded by

ERIE *Plastics*

The dial and the case make the clock, and the ultramodern General Electric-Telechron line stops traffic wherever it is shown. It furnishes an outstanding illustration of what plastics can do to add to sales appeal. It also furnishes an illustration of what ERIE can do to make your designer's dreams a reality.

The ERIE Top-Surface Metallizing used on these clock parts to produce a lasting, non-tarnishing metallic brilliance, is appropriate for many products. ERIE is also known for the outstanding beauty of its three dimensional moldings for nameplates, trademarks, and functional pieces that combine jewel-like richness with utility. Whatever your molding problem, it will pay you to consult ERIE Plastics Division of Erie Resistor Corporation.



ERIE *Plastics Division*

ERIE RESISTOR CORPORATION

MAIN OFFICES: ERIE, PA., U.S.A. FACTORIES: ERIE, PA. • HOLLY SPRINGS, MISS.



Cross section shows sealing edges at (A) inside of container nozzle; (B) top of nozzle; and (C) under bead of nozzle. Closure also seats deeply in mouth, to further prevent leakage.

West Penn Closure Corp., Warren, Pennsylvania, wanted a leakproof seal that could be easily applied by high-speed machinery . . . serve as a dispenser as well as stopper . . . and be practically indestructible.

They found the answer in a polyethylene spout with three different sealing edges, and a self-threading urea cap which formed a tight, yet easily removed top. And they found that Sylvania could hold their required tolerances and produce them in high volume.

West Penn created a leakproof closure ...Sylvania custom-molded it

LIGHTER FLUID, oil and other penetrating liquids, to be effectively packaged, call for a container closure with an extremely tight seal.

Custom molding of intricate parts like this is just one of the reasons leading manufacturers, large and small, come to Sylvania for consultation on parts designs.

Sylvania offers complete facilities for injection, compression, and transfer molding as well as finish and assembly of plastic parts. For complete information on these facilities address Sylvania Electric Products Inc., Parts Division, Warren, Pa.

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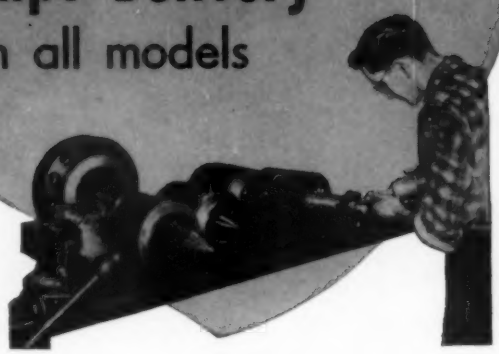
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injection molders . . . Cut Your Molding Costs!

STANDARDIZE with IMS EXTRA CAPACITY UNIFORM DESIGN HEATING CYLINDERS



Prompt Delivery on all models



STANDARDIZE AND SAVE

All IMS Heaters use Standard Low-Cost Uniform Design Nozzles with 1 ¾" - 8 thread. Heater Bands, too, are uniform 4" - 6½" - 8" and 9¼" diameters.

Whatever make of press you run, you now save with standard interchangeable nozzle and heater bands, uniform for any machine equipped with an IMS Cylinder!

IMS Replacement Heating Cylinders are easy to install on Watson, Lewis, Fellows, Reed, Impco, HPM or most any make or model of machine, including "homemade" types!

You get less down time — much lower repair costs — plus production increases up to 50%.

Stock components allow us to build up an IMS Extra Capacity Uniform Design Heating Chamber for your specific press in two to three weeks.

Typical stock models for:

Reed 8	$1198.50
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12 oz. Watson	$2355.00, etc.

OUR MEN KNOW HEATERS

It takes lots of hand work to make good cylinders. Our shop men take real pride in the record established by IMS Uniform Design Heaters. Over 850 in daily use — yet seldom more than one or two in for repairs at any given time.

That's because IMS Heating Chambers are of rugged construction, built to last for years.

We put the quality inside the heating cylinder where it belongs to give you longer life and better production. Not cheaper — but better!

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ANOTHER HPM PROFIT PRODUCER

FASTEST 6 OZ. ON THE MARKET!



5 second cycle at full stroke—up to 900 dry cycles per hour

The all-new H-P-M 6/8 oz. plastics injection molding machine is a husky 30 HP unit that offers exceptionally high speed and dependability. Look at this: platen size 26″x26″ . . . 15″ stroke . . . 25″ daylight . . . clamp and injection ends with independent circuits for simplified trouble shooting and faster operation. At full 15″ clamp stroke, 720 cycles per hour are possible—as many as 900 cycles per hour with reduced stroke. This new H-P-M is ideal for all types of difficult custom moldings and will allow you to compete for those high speed jobs such as required in the packaging industry. And, **it's priced right for profitable molding!** Write for Bulletin 5706 or call in a nearby H-P-M engineer, today.

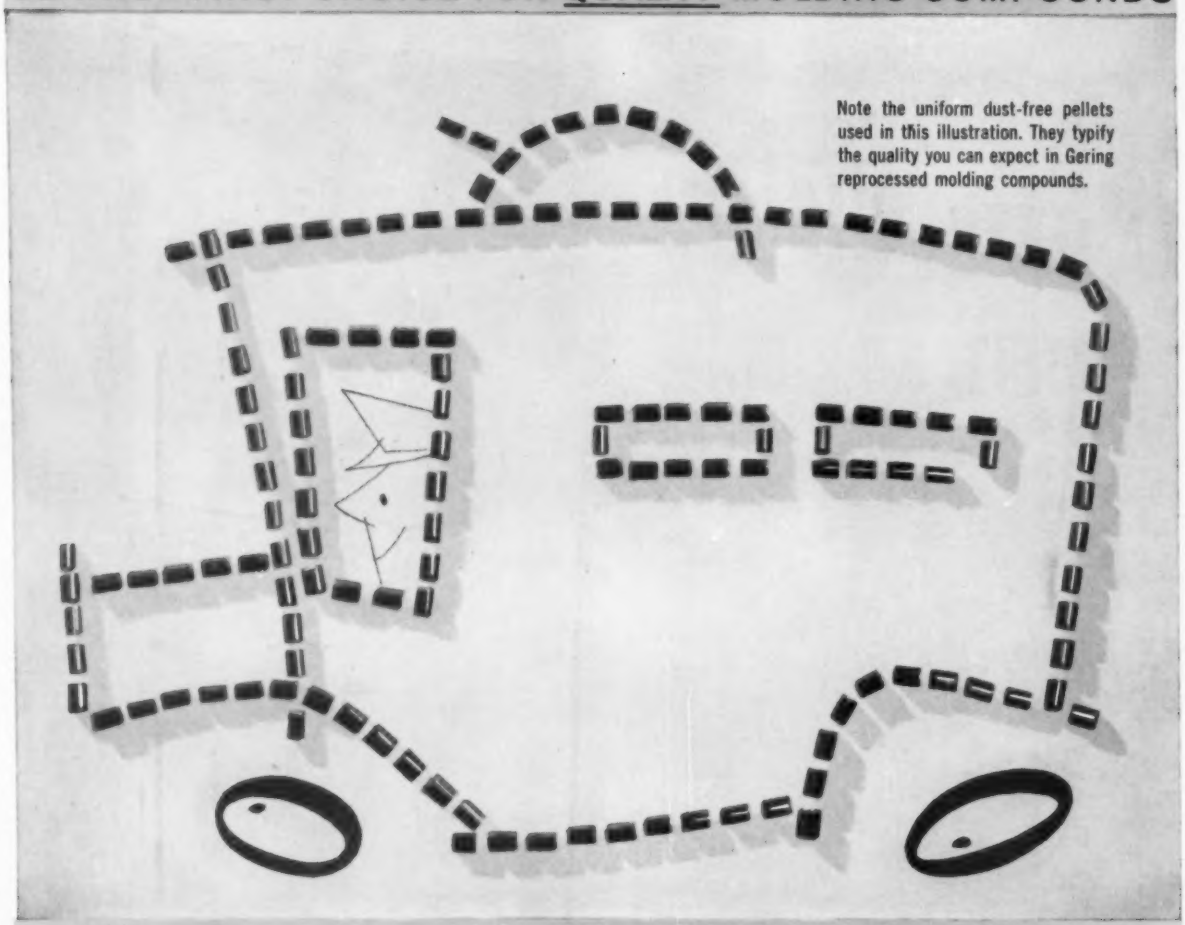
SPECIFICATIONS

Daylight	25″
Stroke	15″
Clamp Tonnage	200
Platen Size	26″x26″
Mold Space (max.)	15″x26″
Plasticizing Capacity	80 lbs. general purpose polystyrene
Injection Speed	675 cu. in./min.
Electric Motor	30 HP

H 824

THE HYDRAULIC PRESS MFG. CO.
Mount Gilead, Ohio, U.S.A.
A DIVISION OF KOEHRING COMPANY

GERING--FIRST CHOICE FOR QUALITY MOLDING COMPOUNDS



Note the uniform dust-free pellets used in this illustration. They typify the quality you can expect in Gering reprocessed molding compounds.

Worth Getting, Worth Guarding

SAVINGS

with **GERING** REPROCESSED THERMOPLASTIC MOLDING COMPOUNDS

• Polyethylene • Vinyl • Styrene • Acetate • Nylon • Acrylics • Styrene Copolymers • Butyrate

There'll be savings by the truckload — for you! Gering reprocessed thermoplastic molding materials mean reduced costs, but not reduced quality. Fact is, molders who are quality-conscious point with pride to the end-products made with these compounds. You will, too. Now, with any given blend, you're absolutely sure of a top-quality molding compound — perfectly matched from first pellet to last. That's always so with Gering's up-to-date equipment, modern facilities and exacting system of quality controls.

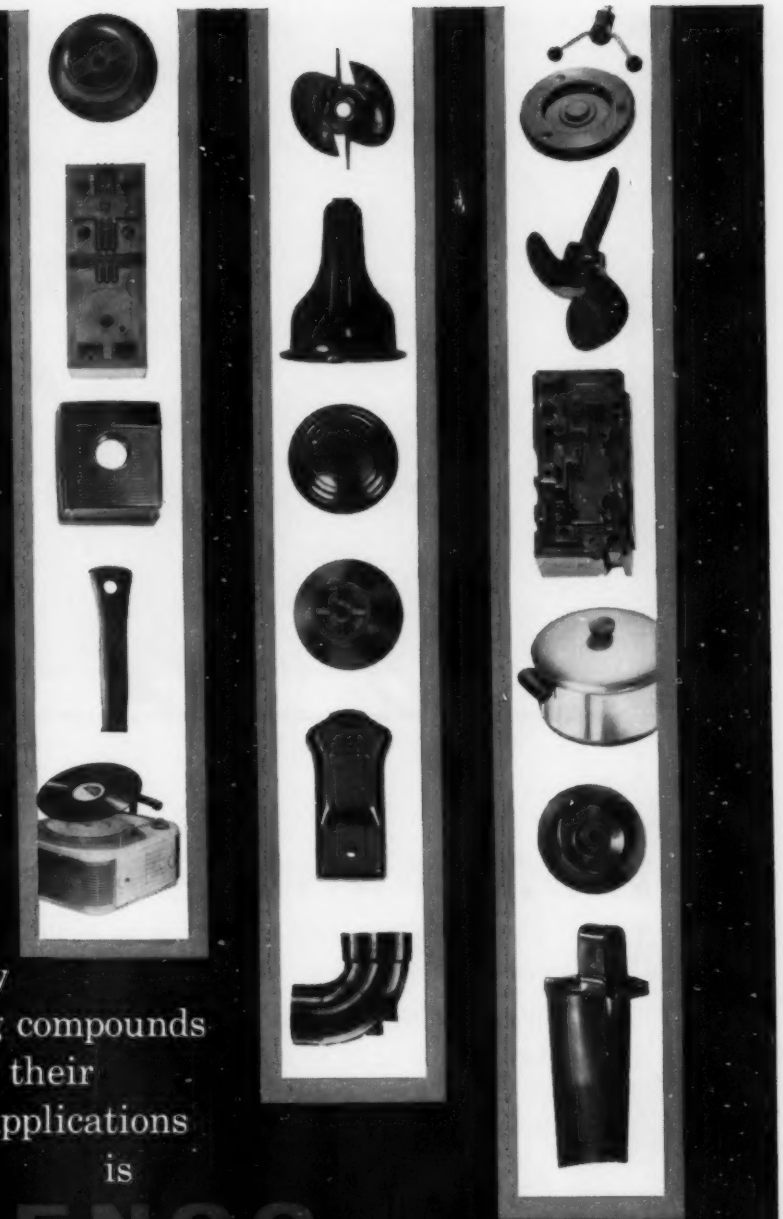
For over 30 years, a continuous policy of individualized attention to customer needs has earned Gering its nationwide reputation for top-notch service.

Special offerings of high quality reprocessed thermoplastics are announced periodically through a new bulletin service. We'll be glad to send these money-saving notices to you. Just write us on your company letterhead.

GERING

Molding Compounds

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A
good word
for quality
phenolic molding compounds
in their
widest applications
is

PLENCO

. . . a good word, too, for dependable counsel. Whether you take our advice or not, you can't help but profit from your consultation with Plenco's problem-solving specialists. And, in production, you can't help but benefit from the wide-ranging knowledge with which these modern molding materials are formulated and the precision with which they are produced.

Does phenolics have the answer for you? Then, chances are that Plenco compounds, in their exceptional variety, versatility and quality-controlled uniformity, can provide it. We invite you to let us demonstrate that.

PLENCO PHENOLICS
FOR BETTER PLASTIC PRODUCTS

PLASTICS ENGINEERING COMPANY
Sheboygan, Wisconsin

Serving the plastics industry in the manufacture of high grade phenolic molding compounds, industrial resins and coating resins.



There must be a good idea for an ad in this picture, but we are doggoned if we can think of one.

We certainly can't work our customers into the copy, considering the kind of animal the artist drew, and there's the fact that we like our customers very much and want them to like us, too.

So we'll just sign off by reminding one and all that we mold almost all plastics by almost all methods, and can do some quite fancy tricks with epoxies, polyesters, urethanes and the like.

And we have been doing most of these things since 1921, under the same management, too.

Give us a ring sometime.

BOONTON MOLDING CO.

BOONTON, NEW JERSEY

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Western New York Area—Alden 7134
Connecticut Area—Woodbine 1-2109 (Tuckahoe, N. Y.)
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Portable warehouses 4 stories high...





An all-weather "Airhouse" of U. S. Rubber Fiberthin vinyl-coated nylon is manufactured by Irving Air Chute Co., Inc., Lexington, Ky. Thermatron generators and presses are used to weld the seams of the structure which is supported entirely by air pressure. At left an "Airhouse" is shown before inflating.

supported by air and THERMATRON electronic welding

No rigid wood or metal framework supports these unique houses – just a thin shell of vinyl-coated nylon and low pressure air. Part of the secret of Irving Air Chute's seemingly impossible "Airhouse" is the airtight, watertight seams permanently welded on Thermatron high frequency presses and generators.

Thermatron welding gives added strength to plastics—seams are actually stronger than the material itself! What's more, it's fast and economical, particularly important in such large scale applications as the "Airhouse," hatch and aircraft hanger protective covers and swimming pool liners.

High frequency plastic welding isn't limited to giant items—Thermatron is a vital cost-cutting, product-improving factor in the fabrication of toys, upholstery, clothing, luggage, automotive assemblies and many other plastic products. In fact, if you fabricate vinyl plastic in any way, Thermatron can point the way to faster and better production methods.

We'll be glad to make tests on your own material and offer suggestions without obligation. Write today to Section MP-1.



Thermatron Division

RADIO RECEPTOR COMPANY, INC.

SUBSIDIARY OF GENERAL INSTRUMENT CORPORATION

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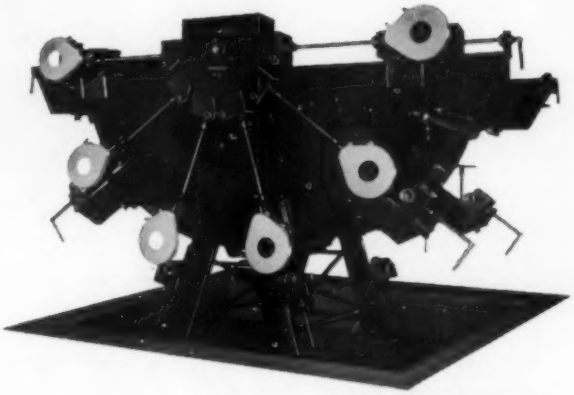
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OTHER RADIO RECEPTOR PRODUCTS: Germanium and Silicon Diodes, Selenium Rectifiers, Communications, Radar and Navigation Equipment

consider

all the advantages . . . and you'll always specify Lembo Rotogravure Presses for all plastic film printing



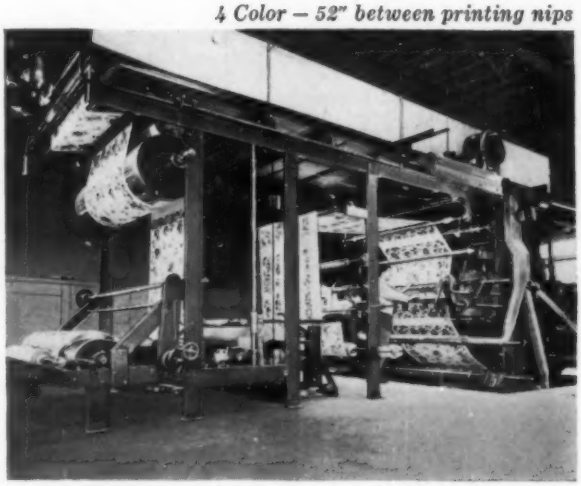
6 Color — 60" between printing nips

*Hydraulic pressure on printing nips** permits operator to simultaneously back away all nips. The printing machine may be stopped, but the engraving rollers keep right on turning. Ink doesn't dry on rollers, so no wash-up is necessary.

Indexing Units allow printing of narrower width film with simple indexing of the impression roller.

The web is carried between impression cylinders—not pulled. This assures perfect, strain-free, in-register printing at speeds up to 125 yards per minute. Your choice of hand, motor or electric eye register control.

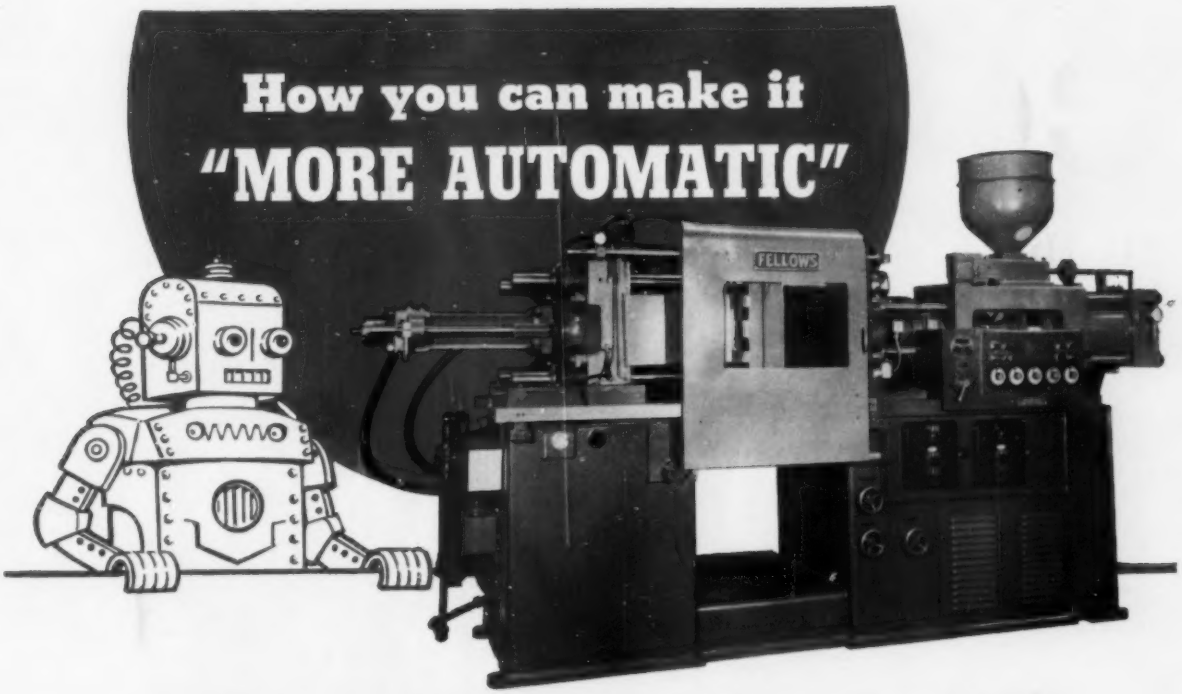
4 Color — 52" between printing nips



Printers of all unsupported and supported plastic film prefer fast, quiet, accurate Lembo Rotogravure Presses. We invite you to see them in operation. Please write or telephone Lambert 5-5555.

LEMBO MACHINE WORKS, INC.
248 East 17th St., Paterson 4, N. J.
Manufacturers PRESSES • EMBOSSERS • LAMINATORS • ROLLERS
*Optional equipment available at extra charge.

ROTOGRAVURE LEMBO PRESS LAMINATION



Attachments Make Fellows "6-200" FULL-AUTOMATIC on Any Job!

Automatic molding pays off in increased production, improved quality of product and lower production costs. The Fellows 6-200 was designed for automatic molding — either partial or full. Its basic design was so planned that the attachments necessary to accomplish the desired degree of automatic operation can easily be incorporated in the machine.

Solving production problems in the molding of containers, closures, cams and a wide variety of consumer and industrial products having internal and external threads, undercuts and side cores brought about the development of a range of attachments which can readily be added to the Fellows 6-200 according to your job requirements. Look over the list — ask for further information on the machine. See for yourself how you can save money by using a Fellows 6-200 Injection Molding Machine, the fastest and most versatile automatic in its capacity range.

Versatile *Fellows Plans* provide convenient short or long-term financing, let your machine pay for itself out of extra earnings. Ask your Fellows representative for the facts. Just get in touch with any Fellows office.

OPTIONAL SPECIAL ATTACHMENTS

- Prepack and pre-position
- Low pressure mold closing protection
- Dual hydraulic knock-out mechanism
- Front knock-out device
- Press stroke interruption and control
- Press speed control
- Air sweeps for article and runner removal
- Multi-nozzle set-ups
- Extra power packs for high-speed injection
- Power take-off for side-action cores or unscrewing
- Conventional air ejection
- Special press control for insert molding

Fellows

injection molding equipment

THE FELLOWS GEAR SHAPER COMPANY, Plastics Machine Division, Head Office and Export Department: Springfield, Vermont
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Give your VINYL products UTMOST JETNESS and GLOSS

Use Columbian's

COVINYLBLAK®-BA

30% DISPERSION OF NEO SPECTRA® MARK II (carbon black)

in vinyl resin in dry chips

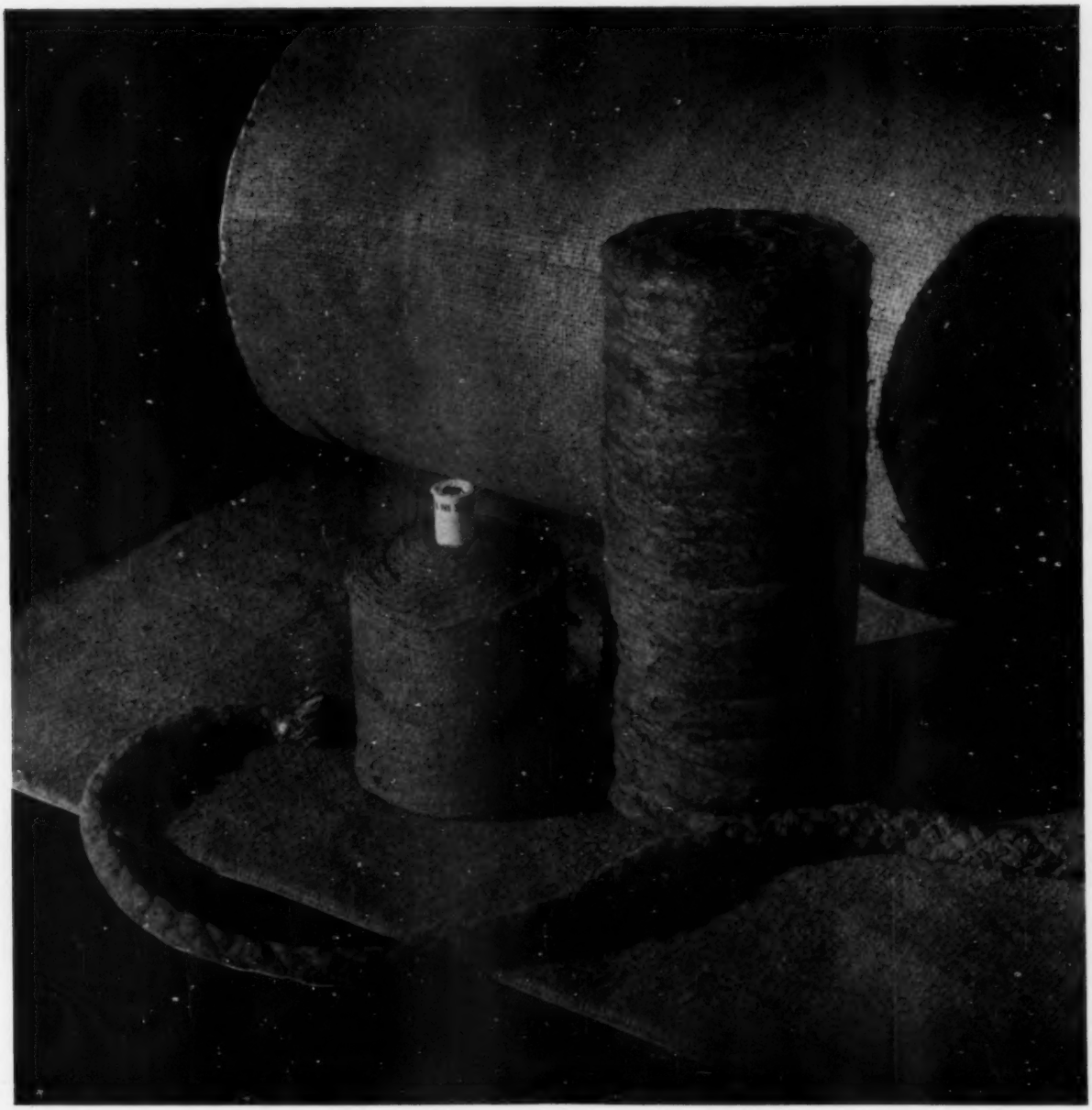
- Eliminates grinding... dirt, labor complaints, equipment maintenance.
- Provides a complete, precisely uniform dispersion... no performance variations from lot to lot.
- Gives utmost jetness, gloss, strength and ultra violet resistance to your finished products.
- Effects economies... a little goes a long way; reduces labor and equipment costs.



COLUMBIAN CARBON COMPANY

380 Madison Avenue, New York 17, N.Y.

● COLUMBIAN supplies Carbon Blacks in three forms: POWDER — BEADS — DISPERSIONS ●



NORAMITE

...Crocidolite and Amosite Asbestos products for reinforcement of plastics

Noramite identifies a group of new products which greatly extend the range of properties normally available in reinforcing fibers. *Noramite* products, all based on Amosite or Crocidolite asbestos, include prepared fibers, rovings, ropes and fabrics. Greater chemical resistance, higher moduli, and greater heat resistance are among the principal advantages of *Noramite* products.

NAAC

NORTH AMERICAN ASBESTOS CORPORATION
Board of Trade Building • Chicago 4, Illinois



The Snap-Cap . . . offers your users unmatched convenience. The cap "POPS" open . . . "SNAPS" shut tightly . . . no matter how often the container is used.



"Push-Up" Convenience . . . Push-up Bottom provides the convenience looked for by more and more users of stick-type products.



Colorful Lithographed Decoration . . . up to 4 colors . . . colors are bright and permanent . . . line art is crisp . . . lettering is clean and sharp.

New . . . Plastic Stick Containers with SNAP-CAPS

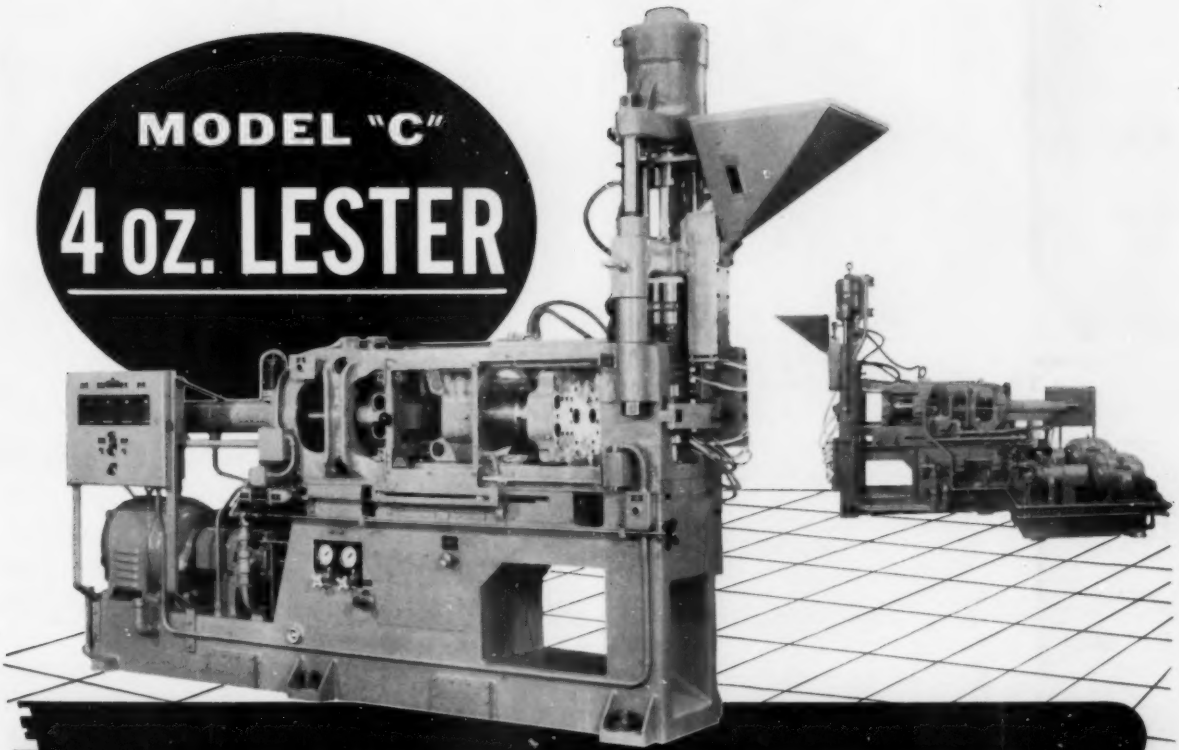
. . . Push-Up Bottoms . . . and bright lithographed decorations

Three basic advantages make this a sales-package that really works at point-of-sale! Its Snap-Cap . . . Push-up Bottom . . . and printed-label advantages give your product the extra convenience and eye-catching appearance it must have! Ask your Owens-Illinois representative to show you samples of the new Plastic Stick Containers. They're available in a wide variety of colors, in 2-ounce liquid capacity. Call your O-I representative, today! Why not now?

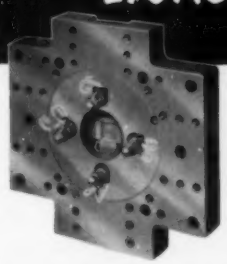
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MODEL "C"
4 oz. LESTER



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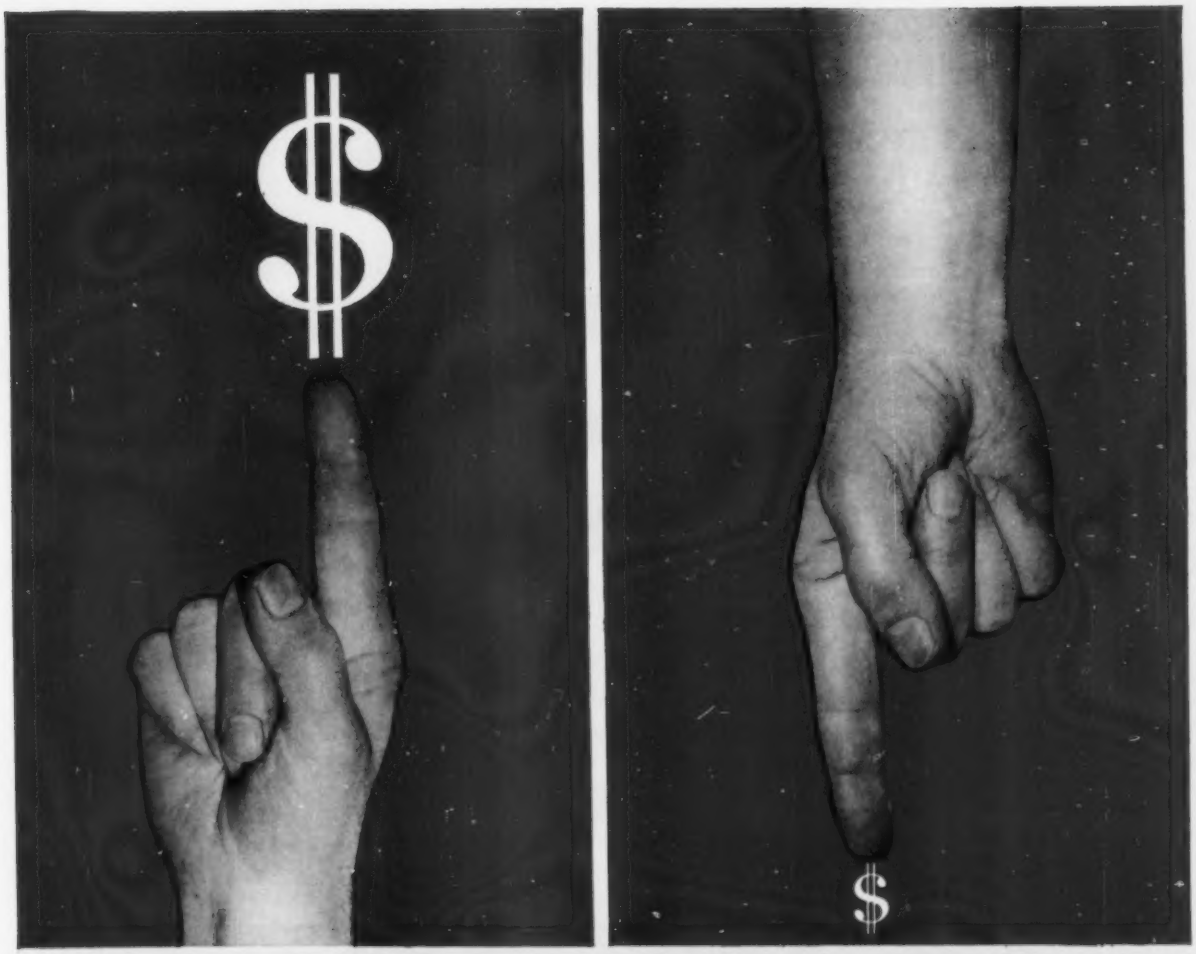
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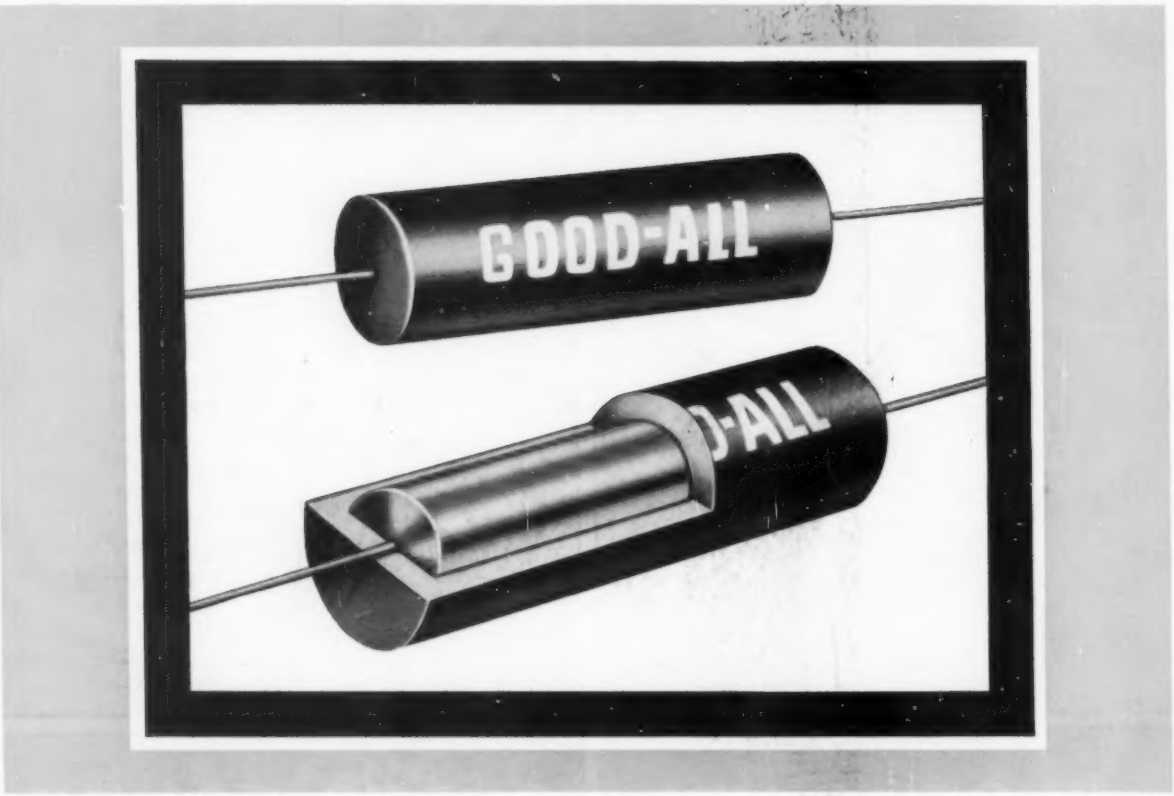
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SHELL

The Plastiscope* February 1958

News and interpretations of the news

By R. L. Van Boskirk

Section 1

Du Pont springs polyethylene patent. Ever since the initial announcement that low-pressure-processed, high-density, linear polyethylene was to be produced in this country and Germany, it has been widely known, and so stated in this magazine, that Du Pont had some sort of a patent position in this field. During all this time there has been a lengthy period of prosecution in the U.S. Patent Office to obtain recognition of the original application filed by Du Pont more than 10 years ago. Patent No. 2,816,883 has now been issued. It is one of a group of ethylene polymerization patents, applications which were filed by Du Pont during the years 1947 to 1951, claiming the discovery of highly linear polyethylene. The company has spent more than $6 million on research leading to this objective, which included investigation of several high- and low-pressure techniques. Another Du Pont patent significantly pointed out by Dr. Frank D'Alelio at the Notre Dame symposium in 1956, is British patent 682,420 filed June 9, 1950 and issued Nov. 12, 1952, which mentions an ethylene polymer with workable densities ranging from 0.9650 to 0.9944; example 13 in this patent even shows a product that has a 1.096 density.

Composition of matter patent. Du Pont patent 2,816,883 is for composition of matter and if not challenged will serve the same purpose as the I.C.I. patent for conventional polyethylene which was licensed to Du Pont and Carbide in this country during the war and to several others later. It expired in 1956. In other words, the Du Pont patent is a product patent and could assertedly be used to prevent production of such highly linear polyethylene material by any known method.

The examples in the Du Pont patent 2,816,883 describe a highly linear or high-density polyethylene produced at high pressure (5000 to 20,000 atmospheres) but Du Pont claims that regardless of how the material is made —be it by a high- or low-pressure process—the patent will affect all polyethylene of from 0.950 to 0.970 density and with an amorphous content of not more than 10 percent. (Conventional low-density polyethylene ranges from about 0.918 to 0.930 and intermediate density of the conventional type ranges from 0.931 to 0.945.)

Confusion might ordinarily be encountered in determining whether or not a given variety of linear polyethylene meets the amorphous percentages covered by the claims, because percentages vary, depending on the test methods involved. But in this case the patent is apparently quite clear inasmuch as on p. 2, col. 4, lines 67-69 of the patent, the specific test method to be used is distinctly cited: ". . . by the method of Mathews et al., Acta Crystallographica 2, 85 (1949) . . ."

(*To page* 37)

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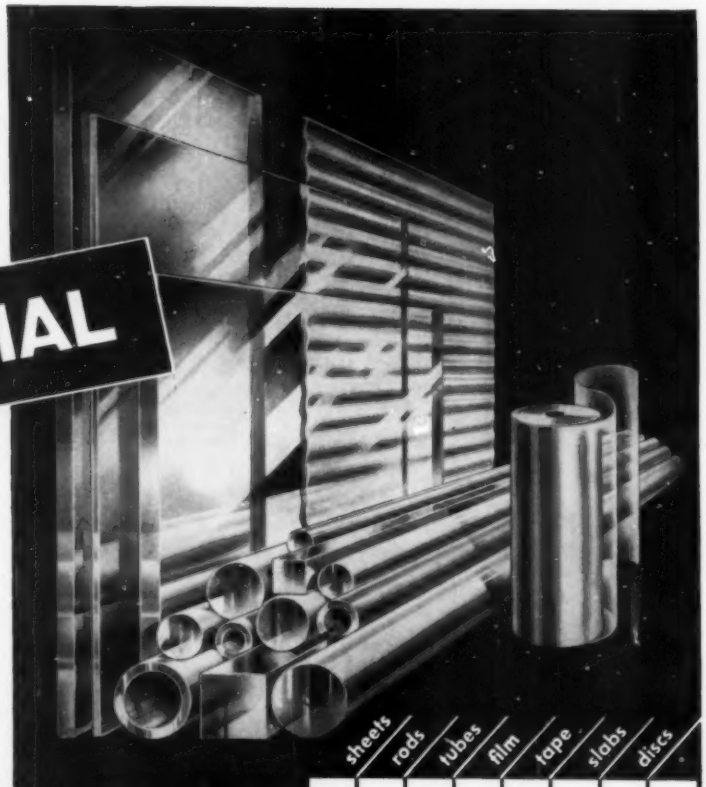
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ACETATE	√	√	√	√				
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The Plastiscope

(*Continued from page* 35)

What Du Pont patent includes. The Du Pont patent would supposedly include the highly linear, high-density, low-pressure-process polyethylene now often described as Phillips, Ziegler, or Standard of Indiana polyethylene. A point in question might be whether or not these latter polyethylenes could be produced at densities below 0.950 or above 0.970 and, if so, without violating the Du Pont patent. But if produced at such densities their properties would probably be different from the high-density materials now in use. Another hooker in the Du Pont patent is that their polyethylene contains "side chains at a frequency of less than one side chain per 200 carbon atoms in the main chain," which structure would probably apply to most highly linear polyethylene now in use in this country.

Other companies have process patents. The Phillips patent applications, it is believed, and the Standard of Indiana patents, are of the process variety covering so-called low-pressure processes of ethylene polymerization. In manufacturing highly linear polyethylene, it is claimed to be possible to employ a number of processes, including several on which Du Pont has patents. However, if the final product has properties falling within the claims of 2,816,883 then, according to a Du Pont spokesman, it is covered by the composition of matter patent, regardless of the method used.

Another angle is that, although the Du Pont claims for composition of matter go back to 1947, the company also filed a claim in June 1949, which was awarded in 1956 (U.S. 2,762,791) for two methods of low-pressure processing. Also, even though Du Pont bought a Ziegler license, there have been disclosures in U.S. patent 2,721,189 (filed August 1954) which would indicate that Du Pont had found catalysts and processes similar to Ziegler's.

Other companies taking a long look. In a statement issued after the Du Pont announcement, Phillips Petroleum said that the Du Pont patent did not interfere or affect their patents for low-pressure-process polyethylene utilizing a Phillips catalyst. The Du Pont patent, it was said, was based on high-pressure processing and it contained limitations which would not affect the Phillips claims. But Phillips says that if the Du Pont patent is determined valid, the effect on production costs of their polyethylene would be minor and its selling price would not be increased; Phillips would presumably acquire a Du Pont license to make the material.

Other producers of highly linear polyethylene have generally said that they will make no statements until the Du Pont patent has been studied to ascertain whether or not it affects their material. Thus, if the Du Pont patent affects only a material of a given crystallinity, other companies may have a material with a lower crystallinity. Or they may have a material with more than one side chain per 200 carbon atoms. And it may be possible that one company using a Ziegler process could be subject to infringement and another not, due to the various limitations of the Du Pont patent.

In any case, the industry feels that production of highly linear polyethylene by other companies is not going to stop because of the Du Pont patent. After all, Du Pont has announced its willingness to license. (*To page* 39)

SECOND OF A SERIES

Chemical Division GENERAL THE GENERAL TIRE & RUBBER CO. VYGEN

THE GENERAL TIRE & RUBBER COMPANY
CHEMICAL DIVISION • AKRON, OHIO



INTER-OFFICE MEMORANDUM

FROM: Product Chemist

TO: Chief Chemist

SUBJECT: VYGEN PVC RESINS

As you requested, we have evaluated the samples of General Tire's Vygen Resins in our lab. Generally speaking, these resins have outstanding heat stability and are free of gelled particles. They are also very good for clarity. Following are specific comments on each resin:

VYGEN 105—The flow properties are quite good, but the thing which impresses me most is its very fine heat stability. When injection molded in the lab, the parts had very good surface gloss. We also evaluated it in our laboratory extruder – again the heat stability was very good, and the surface was glossy and free of imperfections. This resin should be given an extended test in the plant to get a better idea of its heat stability under operating conditions.

VYGEN 110—This resin has excellent heat stability. I recommend it be put into use immediately in the plant on light color jobs where color drift has been a problem.

VYGEN 120—The heat stability of this resin is the best of any we have ever evaluated. We also tried it in a lab dry-blender with polymeric plasticizers, finding it to be completely satisfactory in this use. Extrusions of Vygen 120 were excellent, even with the formulas containing polymeric plasticizers. This one is ready for plant runs.

VYGEN 161—We made up a pigment-plasticizer-resin masterbatch, as suggested, and found the masterbatch to be very dry. This looks like a good answer to how to handle colors in the plant, since it is so much easier to handle than paste or dry pigments. Also, it is much easier to weigh accurately, and will permit much better color control.

Charts, graphs, and samples of evaluation work are attached.

R C Conveyor

Product Chemist

The Plastiscope

(*Continued from page* 37)

Incidentally, it is pertinent to note that although polypropylene is not yet involved in this legal disturbance, it is known that a number of patents on the subject have been issued in foreign countries to Du Pont as well as a number of other companies.

Record-buster month. October 1957 was by far the largest volume sales month ever enjoyed by the plastics industry, as shown by the U. S. Tariff Commission report on p. 188 of this issue. Figures for November and December are not yet available, but sales managers report that November was about like September, which was a very good month but not sensational. However, the bottom is supposed to have dropped out in December to make it perhaps the lowest volume December in the past five years; that twelfth month has often been an exceedingly painful one from a sales manager's point of view. And inventory clean-up was probably a more significant factor in December of 1957 than in any recent year due to uncertainty over prospects for 1958.

What made October so good? Many reasons are offered why the plastics business was so good in October, a month when nearly every business index in the country showed declines. Here is a summary of some of those reasons as they pertain to various plastics materials:

Phenolic molding material: An all-time high of over 25 million lb. was reached. Next best month in 1957 was January with 16.6 million lb.; other months varied from 12 to 15.5 million. Best previous month since 1953 was 18 million lb. in October 1955. Despite the big October volume, it is still expected that total sales for the year will be 20 million lb. under 1956 when they were 200 million. Upsurge in October was probably created by buying for inventory since the industry had been given 60 days notice that there would be a price increase on November 1. Electricals were also good in the fall months. There was reportedly a severe drop in November and December which, of course, was another indication that the October upsurge was at least partly due to inventory build-up.

Polyethylene: October was biggest month in history—67 million pounds. Largest previous month was May, with 59 million pounds. Exceptionally large polyethylene exports were reported, perhaps due to certain companies coming into full production after months of only partial production. Total export for year may go well over 180 million lb. out of a total of 630 million-lb. sales. However, sales were quite good in almost every classification for high-pressure polyethylene.

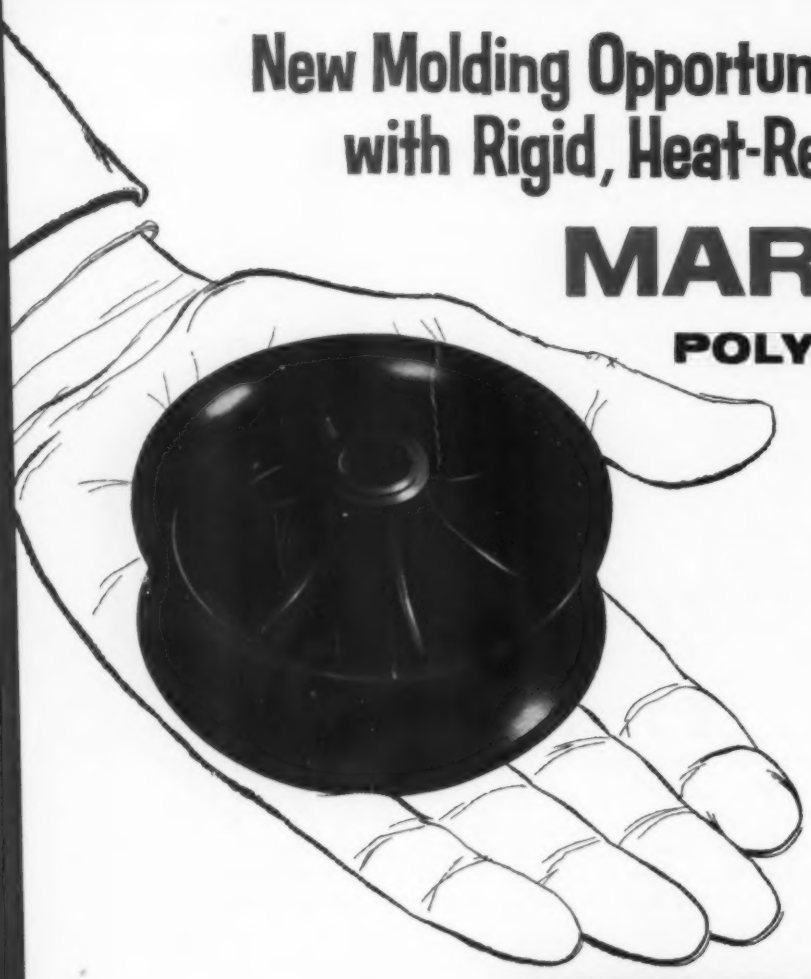
Vinyl chloride: A booming 59 million-lb. month—previous high in 1957 was 53 million in March. Largest previous month was 57 million lb. in October 1956. October sales nearly always spruced up by automotive purchases for new models—may be 60 million lb. used in 1957. Wire coating and floor covering resins reportedly had a severe decline in November and December.

Polystyrene: Record 38 million lb. sold in October—best previous months in 1957 were around 37 million in March and September. Highest of all was 40 million lb. in April 1956. October increase was mostly across the board, but refrigerator business may have picked up due to fall buying. (*To page* 41)

New Molding Opportunities with Rigid, Heat-Resistant

MARLEX* 50

POLYETHYLENE





MARLEX 50 polyethylene is the preferred molding resin for a wide variety of heavy-duty industrial uses . . . wheels, corrosion-proof pump impellers, low-load gears, bearings and other mechanical components . . . glossy, colorful appliance housings, pipe thread protectors . . . and many other die-cast items requiring a low-cost, tough, abrasion-resistant plastic that is chemically inert.



New Sales Service Lab at Bartlesville is completely equipped with latest commercial processing machinery and research apparatus. Phillips experienced technical service staff will assist you in developing new products and processes using MARLEX plastics. Please make arrangements through your local MARLEX sales representative. Meanwhile, for complete data on MARLEX 50, send for our latest illustrated technical brochure.



Ease of extrusion, low permeability, chemical resistance and rigidity of MARLEX 50 plastic make it ideal for blow molding many types of food and drug bottles, squeeze bottles and aerosols. Its stiffness permits reductions in wall thickness with consequent savings of resin. Conventional processing techniques produce high-quality blown products with glossy surfaces and minimum internal stress.



Toys and housewares are a natural for this unbreakable, heat-resistant, nontoxic material. Its high tensile and impact strength and lack of brittleness at extremely low temperatures suggest many new applications unsuited to conventional polyethylenes. Molders can profit from the fact that form stability at higher temperatures frequently permits quicker mold ejection and shorter cycle times.

*MARLEX is a trademark for Phillips family of olefin polymers.

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The Plastiscope

(*Continued from page* 39)

Cellulose molding material: Over 9 million lb. were sold; largest month since October 1956 when volume was just about the same. Has to be credited to Christmas buying.

Urea and melamine: October was largest ever—8.7 million pounds. Probably due to melamine dishware, but urea molding was up, too.

New plastisol with high electrical properties. Pliovic VO, a new polyvinyl chloride dispersion resin developed for plastisols and organosols, is being offered by the Chemical Div. of The Goodyear Tire & Rubber Co. Plastisols made from Pliovic VO exhibit unusually high electrical quality, according to Goodyear, which asserts that plastisols have previously been limited in electrical applications because of relatively poor insulation properties. Pliovic VO will reportedly give electrical properties in the range of standard vinyl compounds, such as Pliovic EDB90V, which to the layman means that Goodyear now has a plastisol potentially capable of moving into the vast insulation field, such as wire coating, where millions of pounds are consumed annually. There is a possibility that this new plastisol will offer direct competition to electrical dry blend extrusion resins and help to reduce processing costs considerably.

Use of Pliovic VO also permits a wide flexibility in choice of compounding ingredients. Eighty plasticizers and plasticizer combinations have been successfully tested without increasing viscosity of the compound. Another advantage is low water-absorption which preserves the good electrical properties of PVC and maintains film clarity.

Blends of Pliovic VO and Pliovic AO, another dispersion resin, combine properties of both to give fast fusion and improved viscosity without use of high oil-absorbing fillers.

Other suggested uses than wire coating for Pliovic VO plastisols are rotational molding, metal spray coating, and dip coating.

It was bound to come—an imitation plastic! An aluminum whiskey bottle closure for Seagram's 7-Crown fabricated to look "like a molded plastic cap" is described in the current *Modern Packaging* Magazine. After all these years of snide remarks about plastics as an imitator, it is sort of curious to see that "nice, bright, shiny" aluminum desecrated to look like a plastic! Who's doing the imitating now? The plastics industry just loves the proposed wedding of aluminum and plastics in structural panels but can be excused for an amused snicker at an imitation plastic in aluminum. Well, "if you can't whip 'em, join 'em!"

Thin cast methacrylate sheets. The Cast Optics Corp., Hackensack, N. J., is now casting its 36- by 48-in. methacrylate sheets in thicknesses of 0.020, 0.030, 0.040, and 0.050 inch. These thin sheets are both optically clear and in transparent colors. It is claimed that such thin methacrylate sheets have been heretofore unavailable and that they have all the qualities of thicker sheets, as well as higher impact resistance and extreme light stability. They are suggested as ideal for precision industrial applications.

For additional and more detailed news see Section 2, starting on p. 234.

Garan® Roving helps Amercoat* meet Rigid Specifications for Glass-Plastic Railing



Garan Roving-reinforced plastic railing at Del Mar Turf Club (California) withstands routine "bumping" from tractors—or horses—without buckling or damage.

Improved weathering characteristics and higher physical properties make this glass-reinforced plastic tubing ideal for many architectural uses—both exterior and interior.

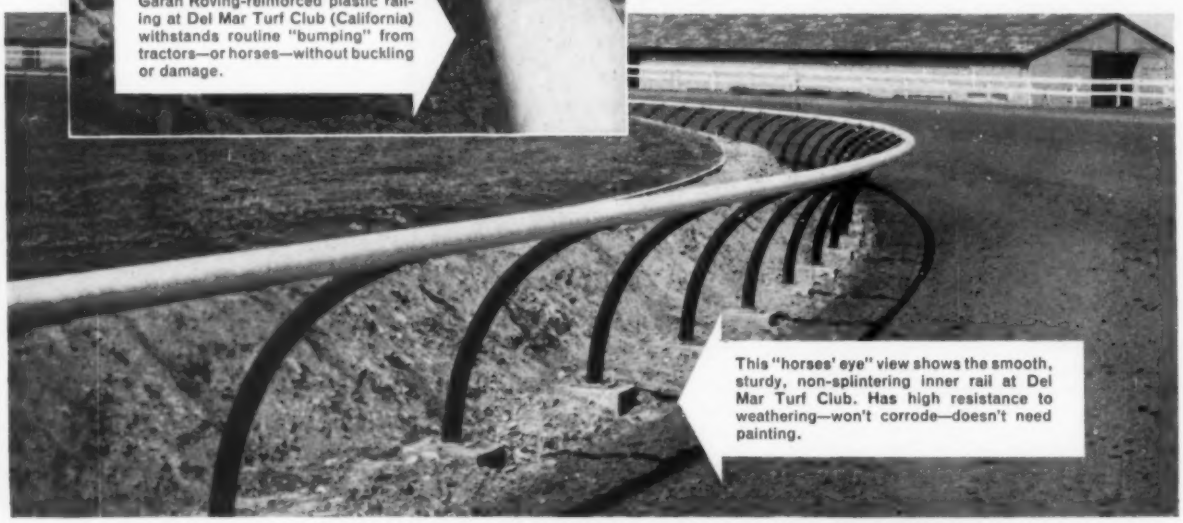
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found that Garan Roving met their exacting requirements in making tubing in diameters from 2" to 12"; with more strength than steel on a weight basis; unusually high flexural strength; lighter than aluminum; better weatherability.

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Garan Roving, made by L·O·F Glass Fibers Company, is the quality reinforcement for preforming, corrugated sheet, rod stock, and woven roving applications.



This "horses' eye" view shows the smooth, sturdy, non-splintering inner rail at Del Mar Turf Club. Has high resistance to weathering—won't corrode—doesn't need painting.

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Citroflex A-4 also finds excellent use in plasticizing vinyls for coating food containers and for producing food wrap films. Citroflex A-2, a companion product, is a nontoxic, odorless plasticizer for cellulose acetate food wraps for both fatty and non-fatty foods. Both Citroflex A-2 and A-4 are accepted by the Food and Drug Administration.

Your Pfizer representative will be glad to explain how Citroflex plasticizers can serve your needs.

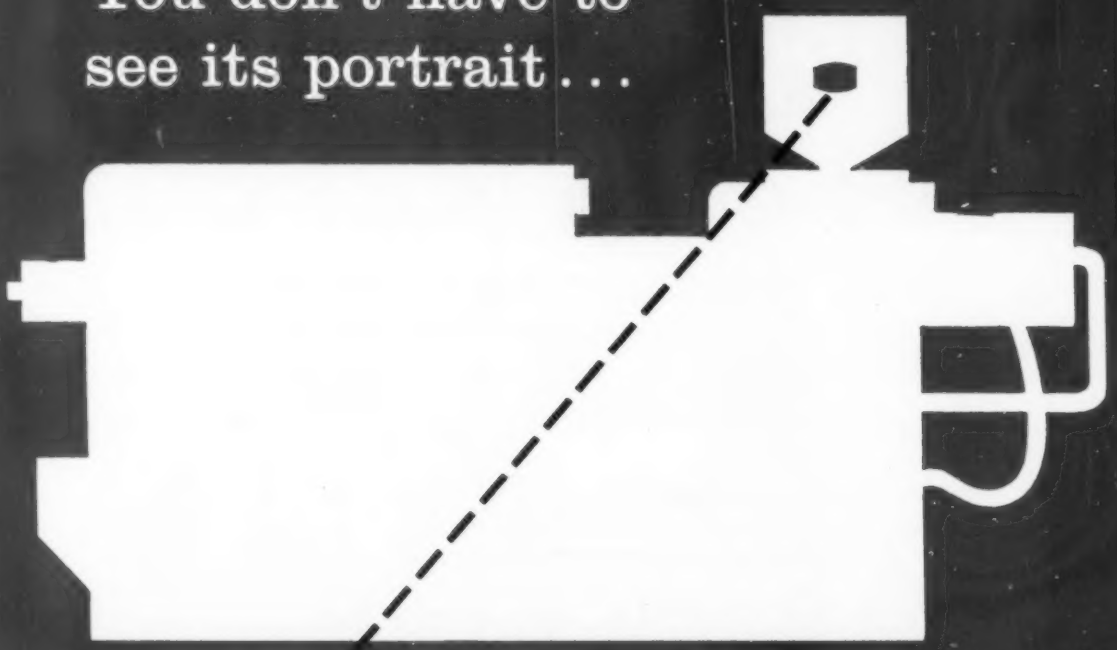
Costs of these citric acid esters are remarkably low, compared to other nontoxic plasticizers. Besides A-2 and A-4, the Pfizer Citroflex line includes Citroflex 2 (Triethyl Citrate), Citroflex 4 (Tributyl Citrate) and Citroflex A-8 (Acetyl Tri-2-Ethylhexyl Citrate). Check into the Pfizer Citroflex plasticizers today.

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THE 4th Annual

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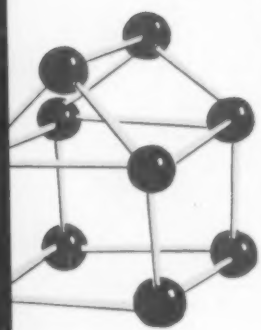
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of television's "Ding Dong School"

Jesse H. Day, Ph.D.
Editor, S.P.E. JOURNAL; Member, Society of Plastic Engineers

William M. Goldsmith
Professional Designer, Design Research, Inc.;
President, American Society of Industrial Designers



Awards

FIVE FIRST AWARD WINNERS (one for each class)

1. A grant of $1,000 to a handicapped children's summer camp of the molder's choice. The grant, of course, will be in the molder's name.
2. A distinctive wall plaque.
3. Attendant recognition, publicity and advertising, and promotion vehicles.

FIFTEEN HONORABLE MENTION WINNERS (three for each class)

1. A distinctive wall plaque.
2. Attendant recognition, publicity and advertising, and promotion vehicles.

Koppers promotion of winners—added benefits to give your award-winning product more sales impact

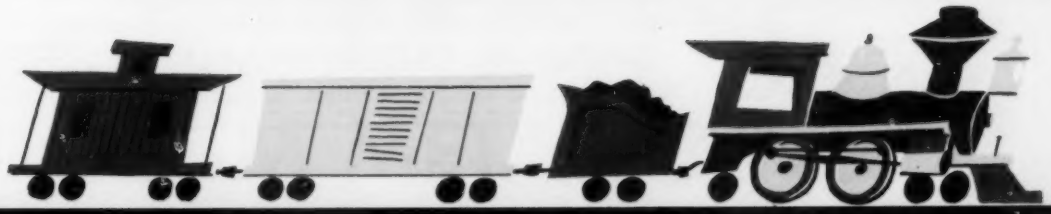
FIRST AWARD WINNERS

1. One page in the September issue of TOYS AND NOVELTIES as part of Koppers 8-page advertisement featuring the best-designed toys of 1958.
2. 5,000 reprints of the above ad for your salesmen, agents, distributors.
3. Personal calls by national merchandising firm to secure tie-in displays of winning toys in selected department and variety stores.
4. Shared two-page ad in PARENTS' Magazine.
5. Approximately 6,000 direct mail letters to jobbers, department store buyers and chain store buyers telling them about the winning toys.
6. Reproduction proof sheets of the 1958 Contest Seal—for use in your own advertising.
7. 25,000 pressure-sensitive labels bearing 1958 Contest Seal—to identify your winner with the national promotion.
8. 200 merchandising kits containing counter easels, banners, etc.—for use by your salesmen and agents in contacting retailers.

HONORABLE MENTION WINNERS

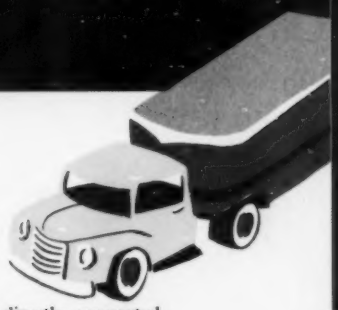
1. One-fifth page in September issue of TOYS AND NOVELTIES as part of Koppers 8-page insert advertisement.
2. 5,000 reprints of the above ad.
3. Personal calls by national merchandising firm to secure displays in selected department and variety stores.
4. Reproduction proofs of the 1958 Contest Seal.
5. 10,000 pressure-sensitive labels bearing 1958 Contest Seal.
6. Option to purchase, at cost, merchandising kits containing counter easels, banners, etc.

PLUS All the newspaper, magazine, radio and TV publicity arising from Koppers Toy Design Contest Awards Banquet to be held in New York, May 21, 1958.



KOPPERS DESIGN COMPETITION

1958 KOPPERS Design Competition FOR EXCELLENCE OF CREATIVE DESIGN IN PLASTIC TOYS



Official Rules

SECTION I—ELIGIBLE MATERIALS

1. Any recognized type of polystyrene, regular, modified or foam, or polyethylene, either regular or rigid, can be used as the medium for the expression of the design in a finished product.
2. The product must consist substantially of polystyrene or polyethylene, and must be a complete and usable item.
3. Parts, accessories or trim may be made from other materials.

SECTION II—ELIGIBLE PRODUCTS

1. Any toy product which qualifies under Section I, and which is produced in the United States for sale in the toy department or section of retail stores, is eligible.
2. Entries also will be accepted from proprietary manufacturers of eligible products, who have the product custom molded by another company. In such cases, awards will be made to either the proprietary manufacturer or the molder, whichever created the design.

SECTION III—BASIS OF JUDGING

Products entered in the Koppers Design Competition will be judged according to the full implications of Pledge No. 3 of the Statement of Principles of the Plastics Industry issued by the Manufacturing Chemists Association and endorsed by the Society of the Plastics Industry:

> Pledge No. 3: "(We pledge to) Use great care to select the correct plastic material for all consumer items, designing and engineering them to insure value, satisfaction, safety and pleasure to all users."

The judges will then consider the entries on the basis of imaginative use of material, proper application of inherent qualities of material, good appearance in relation to use, sound construction in relation to use, and apparent need, or market potential.

SECTION IV—AWARDS

1. Participants in the competition agree, by filling out the entry form, to abide by the regulations governing the awards.
2. Winners of First Awards will be expected to have representation at the Awards Banquet in New York, May 21, 1958.
3. No participant may use the name or symbol of the Competition without the consent of the Koppers Design Competition Administration Committee. Selection as an award winner by the judges automatically constitutes consent to use the name or symbol in any publicity, advertising or promotion directly connected with the award-winning product.
4. Participants may use the name and/or symbol of the Competition in publicity, advertising or sales promotion intended to reveal the fact that a product has been entered in the Competition, provided there is no indication that the product has won an award when such is not the case. All such usages must first be approved by the Koppers Design Competition Committee, 1313 Koppers Building, Pittsburgh 19, Pennsylvania.
5. First Award winners will receive from Koppers a list of all accredited handicapped children's summer camps in the United States. The camp selected will receive a grant of $1,000 in the molder's name.
6. Distinctive wall plaques, suitably inscribed, will be presented to all award winners at an Awards Banquet in New York, May 21, 1958.

SECTION V—DEFINITION OF CLASSES

1. Class I—Hobbycraft Products—Items designed for use in hobbycraft. Typical examples are: HO gauge railroad, construction toys.
2. Class II—Playtoys with a retail value of *more* than $5.
3. Class III—Playtoys with a retail value of *between* $1 and $5.
4. Class IV—Playtoys with a retail value of *less* than $1.
5. Class V—Infant Items—Toy products designed for children too young to walk. Typical examples are: Rattles, teething rings, crib toys.

SECTION VI—SUBMITTING ENTRIES

1. All products must be submitted to the Administration Committee of the Koppers Design Competition before midnight, April 10, 1958.
2. Entries will be mailed, shipped or delivered to:

   ADMINISTRATION COMMITTEE
   Koppers Design Competition
   1313 Koppers Building
   Pittsburgh 19, Pennsylvania

3. Personnel or firms administering the Competition shall not be held responsible for damage to product in shipment, damage as a result of tests, nor returning of product to manufacturer. Nor shall they be responsible for any postage or shipping charges in connection with the Competition.
4. Each product submitted must be accompanied by a separate entry blank, but entrants may submit as many different products as desired.

OFFICIAL ENTRY FORM

4th Annual Koppers Design Competition

KOPPERS

A separate entry form must be filled out for each different product submitted. Additional forms are available on request from any Koppers representative or by writing to the Koppers Design Competition Administration Committee. Before filling out this form, please consult the official rules on page 3 of this folder.

Company Name _____

Address _____

City _____ **Zone** _____ **State** _____

Generic Name of Product Submitted (i.e.—teething ring, HO gauge railroad, etc.)

_____

Trade Name of Product _____

We produce this product as a ☐ **Proprietary Manufacturer** _____

☐ **Custom Molder for** _____

Product is made of: ☐ **Regular Polystyrene** ☐ **Heat-Resistant Polystyrene** ☐ **Regular Impact Polystyrene** ☐ **Heat-Resistant Impact Polystyrene** ☐ **Foam Polystyrene** ☐ **Low-Density Polyethylene** ☐ **High-Density Polyethylene**

We submit this product as an entry only in the classification indicated:
(See page 3 for full explanation.) No entry will be considered in more than one classification.
☐ **Class I—Hobbycraft Products** ☐ **Class II—Playtoys with a retail value of more than $5.** ☐ **Class III—Playtoys with a retail value of between $1 and $5.** ☐ **Class IV—Playtoys with a retail value of less than $1.** ☐ **Class V—Infant Items**

This product is available in the following colors _____

This product was/will be introduced on the market approximately _____
(month) (year)

Approximate Retail Price _____

We understand that no responsibility is assumed by the judging agent for the return of our product entry. We have read the official rules governing the Koppers Design Competition, and agree to comply with them, under the provision that failure to do so will automatically disqualify our entry.

Signed _____
(Name of Company Official)

_____
(Please print or type name here)

. . . Sponsored in the interests of the Plastics Industry by

KOPPERS PLASTICS

KOPPERS COMPANY, INC.
Chemical Division, Pittsburgh 19, Pennsylvania

TEAR OUT ALONG DOTTED LINE

Printed in U. S. A.

TEAR OUT ALONG DOTTED LINE

General Electric Progress Report on

VACUUM METALLIZING





"WE'RE SAVING 50% in tungsten costs with G-E 'Long-Grain' Tungsten", says Mr. Paul Gaeng, Plant Superintendent of Vacuum Metalizing Corp., L.I., New York—shown at left with Louis Gershey, process operator.

G-E "Long-Grain" Tungsten delivers twice as many "shots" per unit!

LONG ISLAND CITY, N.Y.—Vacuum Metalizing Corp., pioneers in vacuum coating with more than ten years of experience, report that, since switching to General Electric "Long-Grain" Tungsten Wire three years ago, their tungsten costs have dropped 50%.

Here's why "Long-Grain" Tungsten delivers outstanding performance in plants of all sizes throughout the country. It is more ductile, it has excellent forming characteristics, and (as proved by Vacuum Metalizing Corp.) G-E "Long-Grain" Tungsten has longer useful coil life.

You can get General Electric "Long-Grain" Tungsten wire in single or multiple strands, or as ready-to-use coils, in the full range of wire diameters that are used in this field. If your particular process requires a custom-made coil, G-E engineers will be pleased to help you design one that will give optimum results.

Don't miss out on cost savings offered by G-E "Long-Grain" Tungsten. Get the whole dramatic story by writing. General Electric Co., Lamp Wire and Phosphors Dept. MP-28, 21800 Tungsten Road, Cleveland 17, Ohio.

Progress Is Our Most Important Product

GENERAL ELECTRIC



Manufacturers of quality papers specify Du Pont Ti-Pure® *titanium dioxide pigment to add brightness and opacity... just as makers of quality printing inks specify Du Pont Pigment Colors for fine reproduction. Reprints of this illustration, suitable for framing, are available on request from your Du Pont Pigments salesman.*

Du Pont Pigments add beauty... practicality... versatility

NATURE'S COLORS ARE RIVALED BY DU PONT PIGMENTS

The macaw's myriad colors captured with easily dispersed, lightfast Du Pont Pigments for your plastics

You can capture Nature's most brilliant colors for your plastics – create others even the macaw would envy—with Du Pont Pigments. In addition to a wide range of colors, these pigments give you many important sales advantages—properties that help your plastics stay brighter longer.

LIGHTFASTNESS – For example, "Monastral"® and "Ramapo" Blues and Greens and Green-Gold are the most lightfast of all organic pigments—an especially important feature with your pastel-colored plastics.

BALANCED PROPERTIES – Resistance to bleed, migration and crocking are desirable properties in many plastics systems. In addition to the "Monastral"® Greens and Blues, the Chrome Yellows, Molybdate Oranges, "Watchung" Reds and Green-Gold are also highly resistant to bleed, migration and crocking, and are easily dispersed.

COLOR STANDARDIZATION – You can rely on close color standardization of Du Pont Pigments to simplify color-matching problems . . . with both color and Ti-Pure® titanium dioxide white pigments.

Du Pont technical assistance is available to assist you in the pigmenting of your plastics. For information, consult your Du Pont Pigments representative or write: E. I. du Pont de Nemours & Co. (Inc.), Pigments Department, Wilmington 98, Delaware.

• • •

Here are a few of the fine pigments in the Du Pont line offering the properties you require:

Ti-Pure® titanium dioxide
Green-Gold—
Durable Organic Yellow
Monastral® Blues and Greens
"Ramapo" Blues and Greens
Molybdate Oranges
Chrome Yellows
Shading Yellow
"Watchung" Reds
Pyrazolone Reds



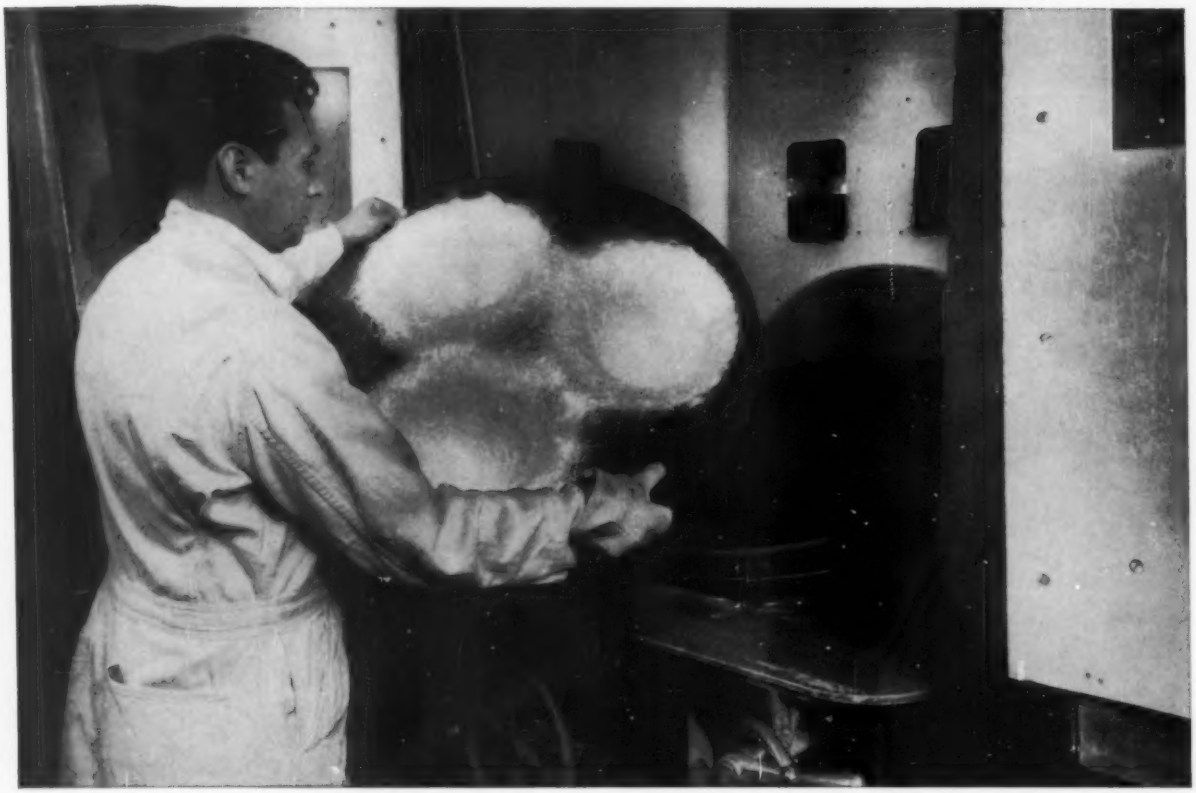
A variety of bright, intense colors, available from the Du Pont quality line of pigment colors, are displayed by Chrome Yellow, "Monastral"® Blue and Green and "Watchung" Red used in heat-sealable polyvinyl foam.

PIGMENTS DEPARTMENT

DU PONT

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

to fine products everywhere



Here's how PITTSBURGH FIBER GLASS can help you make better laminated and molded products

1... through top-quality uniformity

Pittsburgh Fiber Glass, produced by the direct melt process under close control, is a top-quality, uniform reinforcement with exceptional strength, dimensional stability and dielectric strength . . . that is fire resistant, heat resistant and odorless.

2... with the right reinforcement for your needs

YARNS—supplied to weavers in any twist or ply in all standard sizes. Reliable uniformity of Pittsburgh Yarns has won its acceptance for use in cloth laminates for military applications.

ROVING—available in a variety of finishes and end counts. Custom wound for your requirements. Static-free Pittsburgh Roving makes pre-form operations easier and faster, produces better quality end products.

CHOPPED STRAND—supplied in lengths ¼" and up. Packaged for convenient handling. High uniform quality reduces percentage of rejects.

3... and technical assistance

You can arrange to have free trials made right in your own plant to show you how Pittsburgh Fiber Glass can help you produce better products. Write or call your nearest Pittsburgh Plate Glass sales office or our main office in Pittsburgh.

Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Pa.

PITTSBURGH FIBER GLASS IS A PRODUCT OF THE FIBER GLASS DIVISION OF PITTSBURGH PLATE GLASS COMPANY

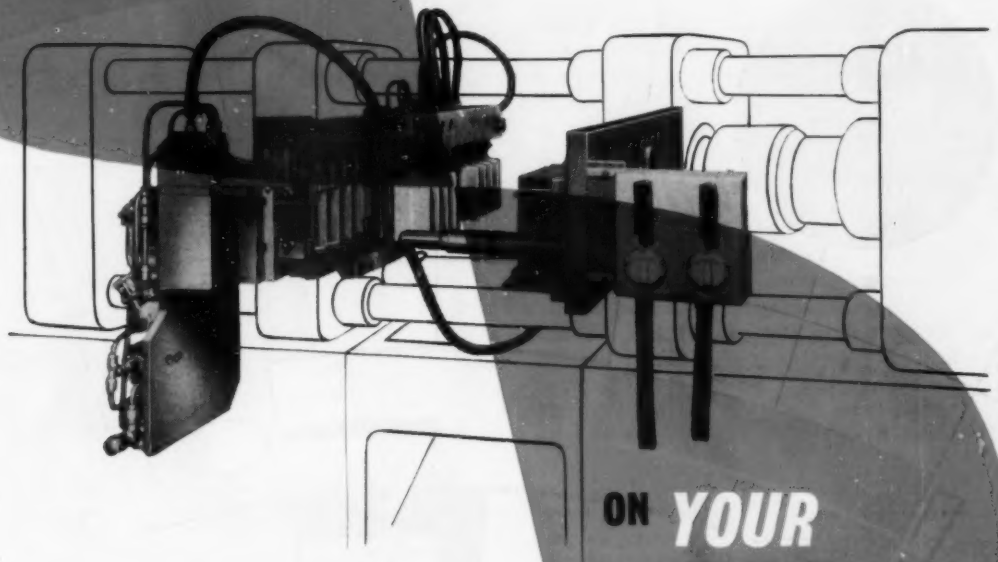
Sales Offices are located in the following cities: Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh and St. Louis

75th ANNIVERSARY 1883—1958 PPG

SYMBOL OF SERVICE FOR SEVENTY-FIVE YEARS

PITTSBURGH PLATE GLASS COMPANY

AUTOMATIC BLOW MOULDING



ON *YOUR* STANDARD INJECTION MOULDING MACHINE

It is now possible to purchase automatic special blow moulding plant! Simply adapt your standard injection moulding machine with the new, amazingly efficient Granbull Blow Moulding Unit . . . and open up fresh sources of profitable production. Designed for multi-impression work with 'push-button' speed and precision, to the maximum capacity of your machine. Write for full technical details.

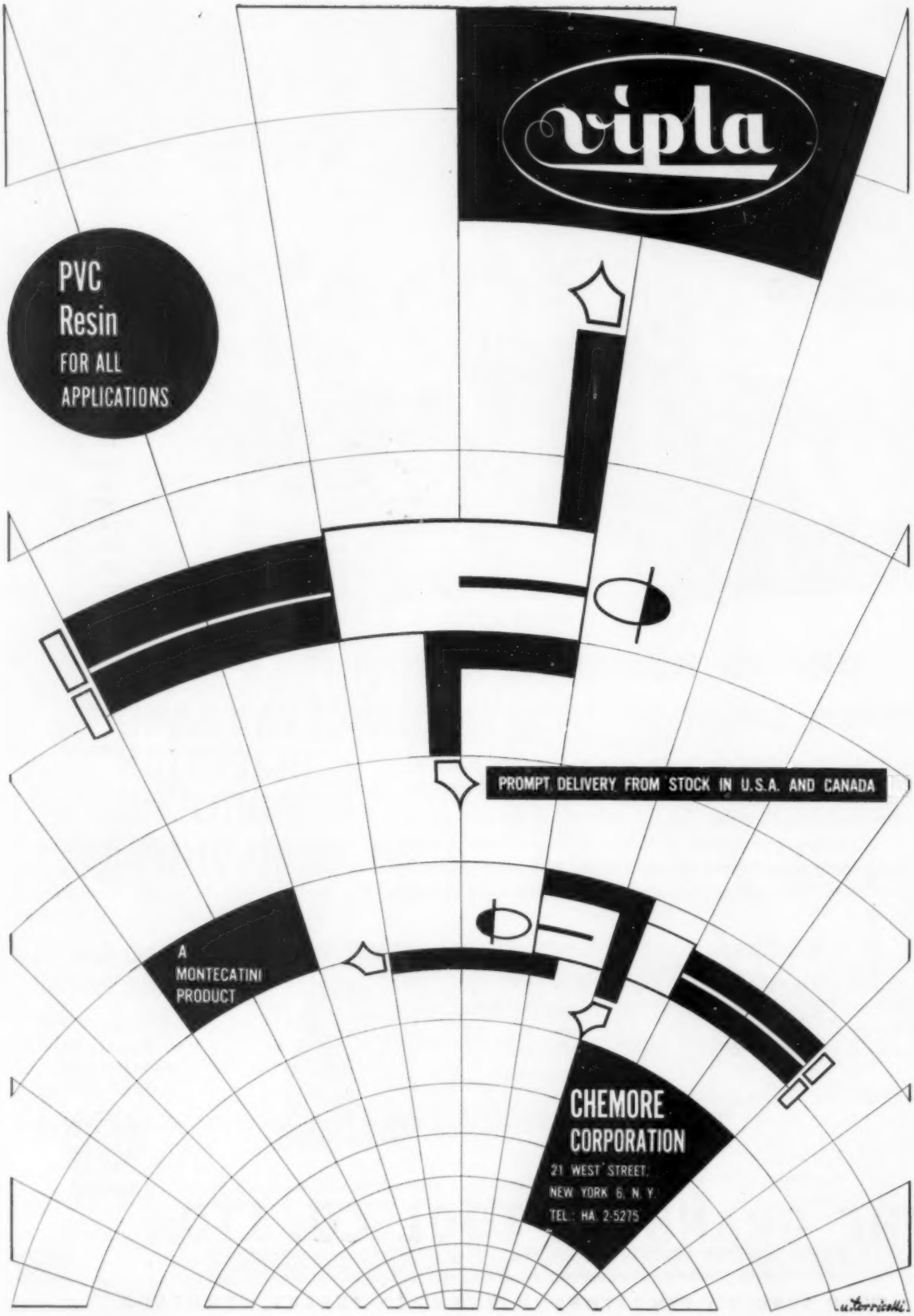
OUR MANUALLY OPERATED EQUIPMENT ALREADY USED BY MANY MOULDING COMPANIES IS SUITABLE FOR FITTING TO STANDARD MOULDING MACHINES

Agents in principal countries

THE GRANBULL TOOL CO. LTD

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Companion Machine For Mold and Die Millers

Toolmaster



Style 1B Toolmaster Milling Machine. Equipped with 1 hp spindle head; collet chuck type spindle nose, capacity ⅛" to 1" shank cutters; power feed to quill; worm positioning of swivel head. Catalog No. M-1870-4.

Every die shop needs one or more Toolmasters to handle the simple milling operations at the lowest cost. Toolmaster performance is tops. They're sturdily constructed to take straight and angular milling cuts up to 1 hp capacity; they're easy and convenient to operate. And there's no end to the advantages of Toolmaster features. Large no-glare dials are easy to adjust for depth of cut . . . overarm is equipped with a pinion for easy positioning . . . spindle lock to facilitate changing of cutters . . . spindle motor starting switch located on the head . . . Shaping Attachment and a host of additional extra equipment. A brief review of your shop facilities will quickly show how Toolmasters can relieve the pressure of work on expensive die sinking machines. Write for our attractive catalog No. M-1870-4, or look in Sweet's Machine Tool File for brief specifications.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

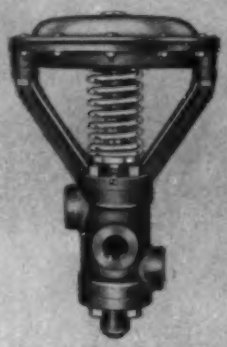


The Toolmaster's smooth, accurate manual feed is a big help in milling the inside of box shaped sections . . . the operator can readily work with two hands on the controls while watching the cutter.

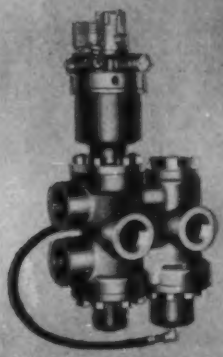
CINCINNATI

MILLING MACHINES • BROACHING MACHINES • CUTTER AND TOOL GRINDERS • SPECIAL MACHINE TOOLS • METAL FORMING MACHINES HARDENING MACHINES CUTTING FLUID • GRINDING WHEELS

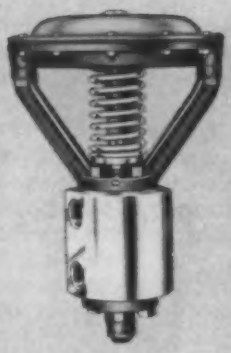
for push button automatic control . . . faster action . . . trouble-free service . . .



4000 PSI BALANCED 3 WAY VALVE



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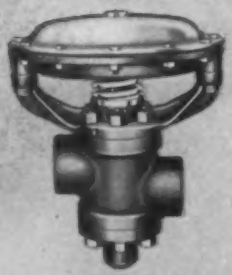
6000 PSI BALANCED 3 WAY VALVE

SPECIFY

SINCLAIR-COLLINS

DIAPHRAGM-OPERATED CONTROL VALVES

2, 3 and 4 way • single or two pressure • high or low pressure — air operated, oil operated • for oil, air, steam, hot or cold water service • remote manual or automated control



4000 PSI 2 WAY VALVE —DIRECT ACTING —NORMALLY OPEN TYPE



4000 PSI 2 PRESSURE, HYDRAULIC OPERATING VALVE—AUTOMATIC HIGH PRESSURE

Any rubber or plastic processing equipment you manufacture or operate will perform better—at lower cost—with Sinclair-Collins valves!

Shockless inlet and release pressures, Stellite valve stem seats, replaceable hardened stainless steel seat sleeves, cast navy bronze (4000 psi) or hi-tensile bronze alloy billet (6000 psi) valve bodies which resist the corrosive action of water and high velocity hydraulic fluids . . . all these features add up to peak, trouble-free performance and lower maintenance costs!

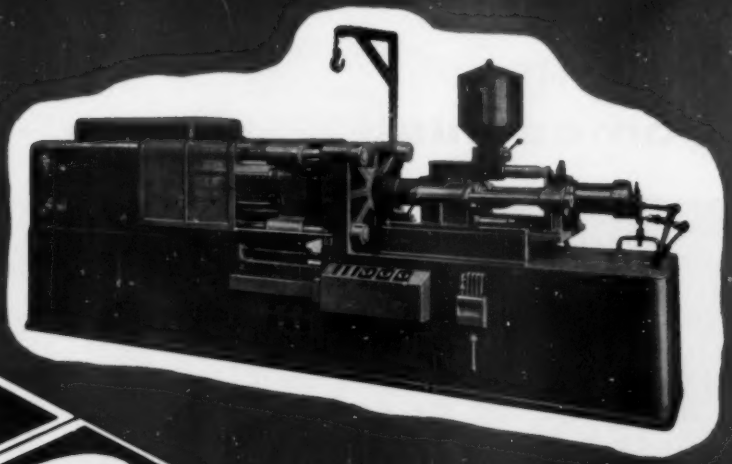
Consider your high pressure valve requirements carefully. Then call in your nearby Sinclair-Collins representative. You'll find that he can supply your valve needs *exactly* . . . in sizes from ½ to 3 in. . . . all available for fast delivery from stock. Write for brochure. The Sinclair-Collins Valve Company, 454 Morgan Avenue, Akron 11, O.

AA-6909

Representatives in principal cities

THE SINCLAIR-COLLINS VALVE COMPANY

454 Morgan Avenue • Akron 11, Ohio



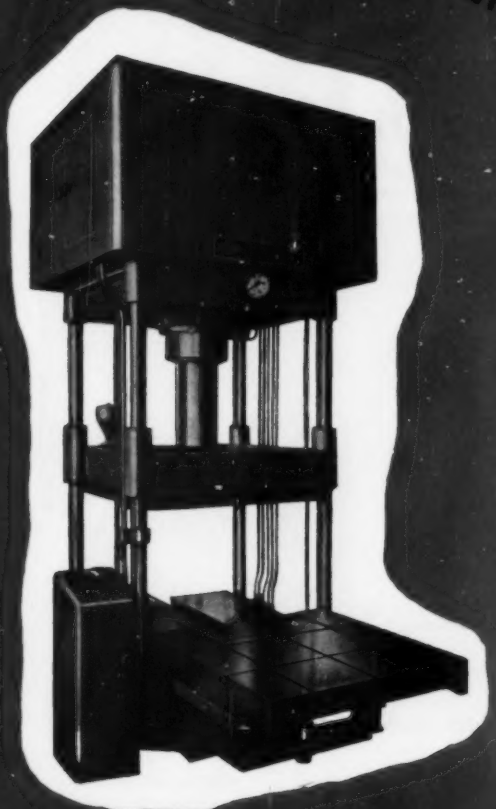


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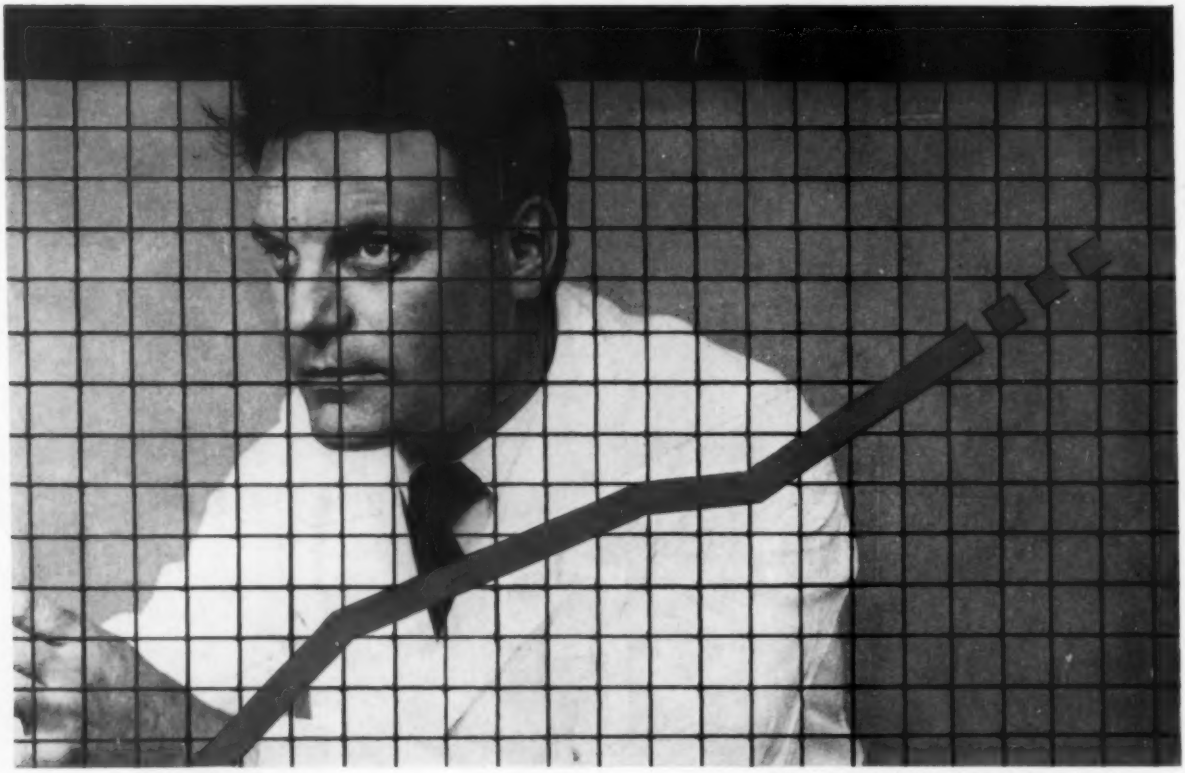


Machines for

Plastic

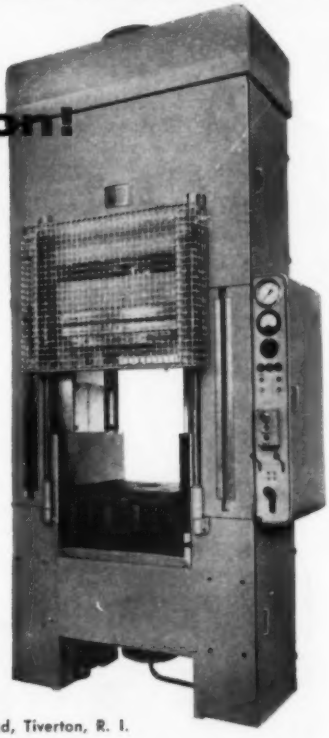
Materials

DOWN comes this BIPEL guard-



"BIPEL" is a Registered Trade Mark World Patents Granted or Pending

UP goes your production!



Each time your BIPEL automatic guard drops, your production surges ahead at an unmatched rate! Auto-Control spells the difference: precise automatic reproduction of *any required molding cycle* . . . at the touch of a button! Your reward? Extra cycles per hour, virtually no rejects, no over-cured molds to clear, economical installation and maintenance. Get *all* the facts first. You'll surely choose BIPEL!

BIPEL Compression-Transfer Presses are available in 3 models, each with a selection of 3 pressures, all ranging from 23 to 336 tons. Modified standard models up to 450 tons. New Loading Table offers automatic feed and stripping, too, for any BIPEL press to 170 tons . . . with quick conversion back to semi-automatic, if desired. Ideal for long runs.

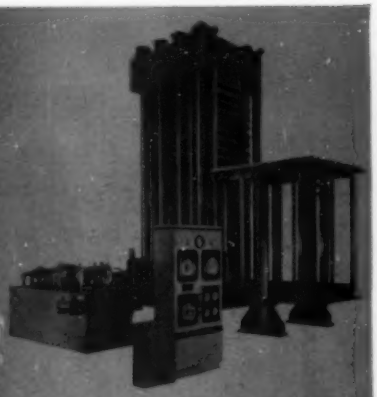
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BIPEL

B. I. P. ENGINEERING LTD.
Sutton Coldfield, England

Canadian Inquiries to:
JOHN SPERLING & CO., 739 Mountain St., Montreal 3, Que.

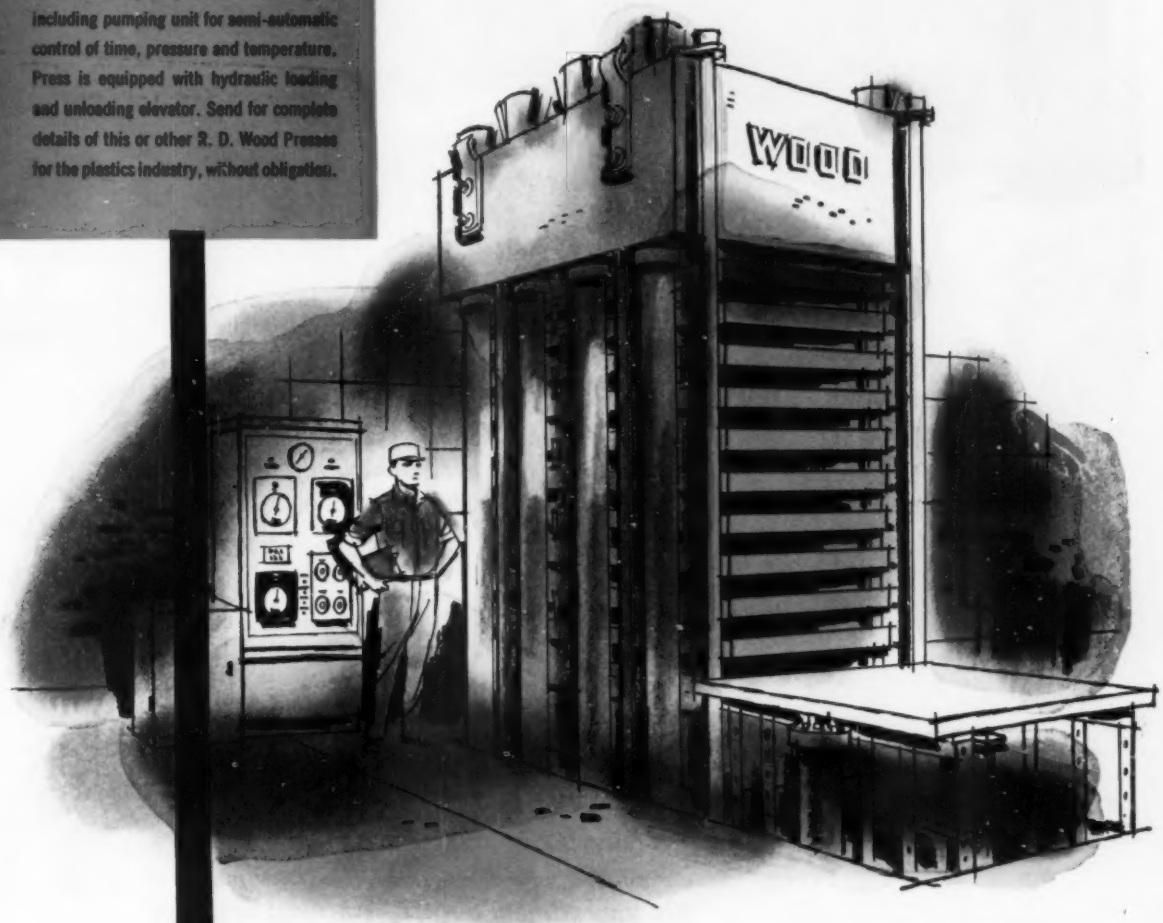
American Inquiries to:
RALPH B. SYMONS ASSOCIATES, INC., 3571 Main Road, Tiverton, R. I.



2,000-ton R. D. Wood Hydraulic Press for laminating and polishing plastics. Press has 10—4" openings, platen size 42"x83", and is of the completely self-contained type, including pumping unit for semi-automatic control of time, pressure and temperature. Press is equipped with hydraulic loading and unloading elevator. Send for complete details of this or other R. D. Wood Presses for the plastics industry, without obligation.

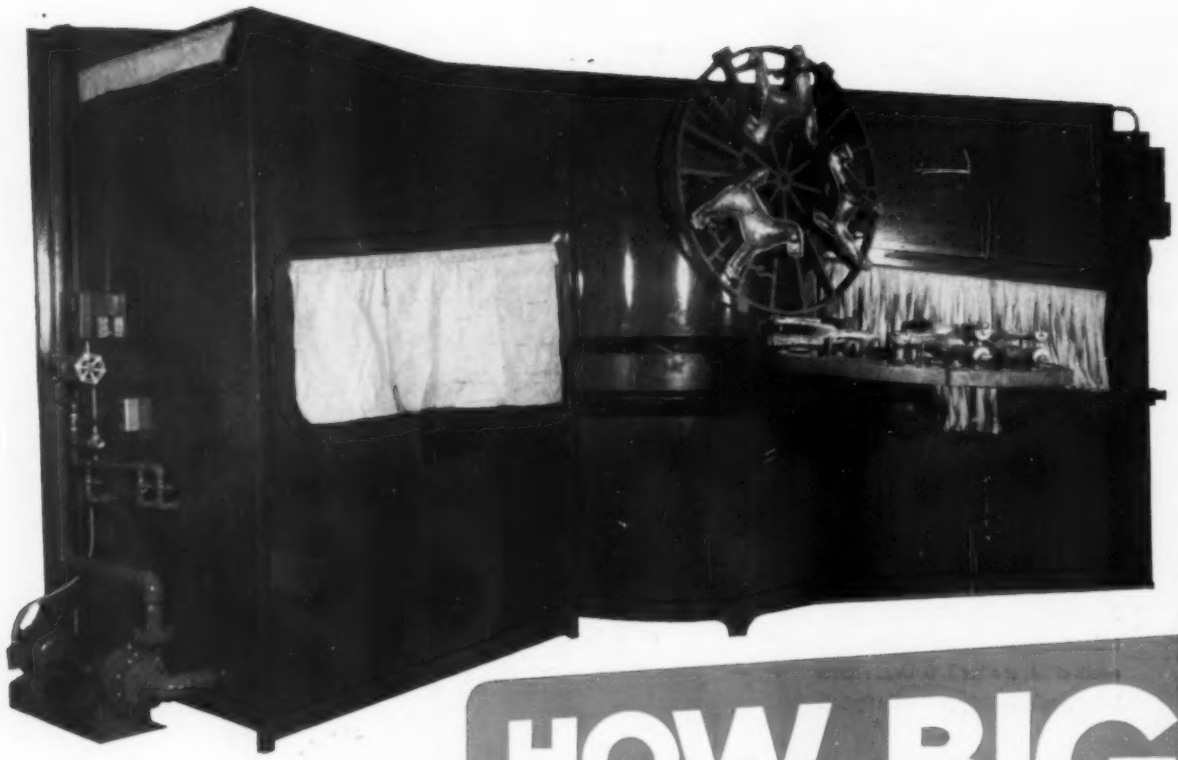
The most productive plants use R. D. Wood Presses

For proof, look at production records—and downtime for maintenance. Then watch an R. D. Wood Press at work. See for yourself the smooth, precise operation—the dependable performance—even under tough conditions. Finally, inspect an R. D. Wood Press up close. Notice the soundness of design, the excellence of materials, the scrupulous care given to each detail of construction. These are the reasons why R. D. Wood Presses are the standard of excellence throughout the plastics industry.



R. D. WOOD COMPANY

PUBLIC LEDGER BUILDING • PHILADELPHIA 5, PENNSYLVANIA



HOW BIG

Big Machines And Big Products



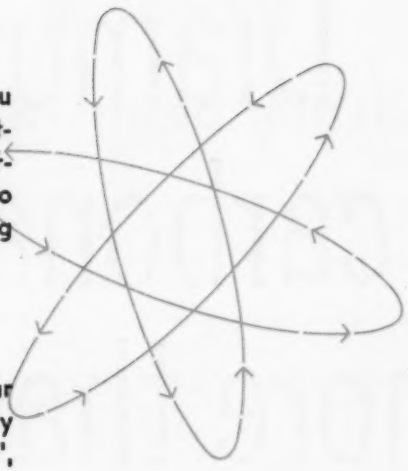
We don't place a limit on big but we do say the products now available by rotational molding on our new machine are "big" . . . as much as eight times as big as previously thought possible.

Imagine, a rotational casting machine with a molding area equal to 75" diameter x 20" high. Now you can mold large complicated items such as the hobby horses shown here. Also mold scooters, sport cars, manikins, animals, etc. into one hollow seamless piece.

This machine operates just as economically as our smaller machines, converting raw materials into finished goods in one continuous operation. The polyvinyl chloride plastisols are scientifically prepared for you by the nation's foremost companies. The automatic features of the machine control the cycle so completely, that only two operators are necessary, giving you a very low labor cost.

Big Production and Big Profits

The production possibilities are enormous. You can produce 60 hobby horses or up to 200 slightly smaller articles per hour. With such high hourly production and low labor costs, it is plain to see that parts produced on this machine are big profit items.



See for yourself!

Visit our plant and let us show you how your product, large or small can be automatically molded. Machines available with a 15", 25", and 75" diameter molding area.

IS BIG?



Write or call for detailed data or an appointment

THE AKRON PRESFORM MOLD CO.

Phone WA 8-2105

2044 Main Street, Cuyahoga Falls, Ohio

FORMS	MOLDS	DIES	MACHINERY
LATEX DIPPING	STEEL AND ALUMINUM	PLASTIC INJECTION	SPECIAL AUTOMATIC

Diamond calcium carbonate fillers do more than save money

Sure, you can shave your costs* by filling glass-reinforced polyester resins with precipitated calcium carbonates. But just as important—in a quality-demanding market—is the fact that DIAMOND fillers help turn out products with these improved properties:

Smooth surfaces

Surfaces of *filled* reinforced polyesters are definitely better than those that aren't filled. Glass fibers are hidden. Deep cracks in resin rich areas are eliminated.

Controlled viscosity

Unfilled resin tends to flow from between closed match dies. You waste resin. Filled resin, because of its higher viscosity, stays within the mold's confines. Using the proper DIAMOND filler, you can control the viscosity and give the resin a body most suitable for the operations involved.

Decreased shrinkage

Fillers greatly reduce the shrinkage occurring during polymerization.

Greater wet strength

After immersion in water for seven days, filled polyesters show less loss in physical properties than unfilled ones do.

More even cooling rate

Polyester resin cools five to six times faster than glass fibers. This makes the fiber pull away from the resin, particularly at the surface. You get a surface that's difficult to paint. A precipitated calcium carbonate helps the resin mix and the glass fibers cool at a more even rate. The surface is smoother, easier to paint.

These improved properties reduce rejects and eliminate "touching up."

What fillers? DIAMOND suggests these four:

Surfex® MM—Particle size: 1 to 5 microns. Resin coated. Oil absorption 20-22 cc per 100 grams. Maintains low viscosity for a given filler concentration. Wetted very easily by resin.

Kalite®—Particle size: about 1 micron. Oil absorption 28-32 cc per 100 grams. Recommended for draw work.

Suspenso®—Particle size: 1 to 5 microns. White. Uncoated. Oil absorption 20-22 cc per 100 grams. Use in applications where pot life is critical. Eliminates crazing in resin rich areas.

Multifex® MM—Particle size: .05-.06 micron. Uncoated. Gives reinforced plastic a smooth white, nonporous finish. Requires less extra work after molding. Little buffing required.

*Your nearby DIAMOND sales representative can show you money-saving formulas and detailed cost comparisons. Or ask for Bulletin No. 8. Write DIAMOND ALKALI COMPANY, 300 Union Commerce Building, Cleveland 14, Ohio.

Sales Offices: New York, Philadelphia, Pittsburgh, Cleveland, Cincinnati, Chicago, St. Louis, Memphis, Houston.

Diamond Distributors: Carmona & Hawxhurst, San Francisco; Dorsett & Jackson, Los Angeles; Van Waters and Rogers, Inc., Seattle and Portland, U.S.A.; Harrisons & Crosfield (Canada), Ltd.



Diamond Chemicals

Consult YARDLEY for:



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PROFILES— in color or clear, flexible or rigid to your specifications.

GASKETS— intricate shapes for almost every industrial application.

TUBING— in special shapes or standard, rigid or flexible in diameters from ⅛" to 16".

Whatever the shape or size, Yardley's precision production and know-how assure consistent, uniform accuracy of your extrusions in quantities. Our advanced techniques can save you time and money on exactly the right shape for your specific requirements. Send us your prints for quotation.

2. Fabricated parts
ready for your production line

We shape, flatten, curve, swedge, drill and perform many other fabricating operations to make your plastic parts ready for use. Close tolerance, absolute uniformity, dimensional stability and high-gloss finish are standard production requirements at Yardley.

3. Packaging ideas



This smart package for the protection of spark plugs from dirt and moisture is made of extruded polyethylene tubing. Heat sealing operation is performed automatically on a machine especially designed by Yardley engineers. We may have the solution to your packaging problem. Write us today.

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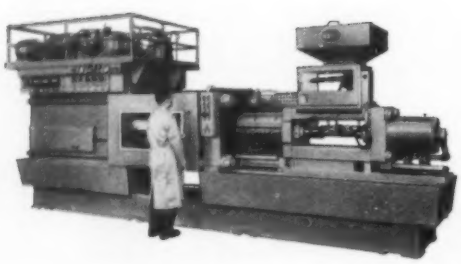


THE NATCO 400

WESTERN ELECTRIC installs the new NATCO

To mold the popular colored telephone parts, Western Electric (Indianapolis Works) has recently installed a new Natco 400. Here is precision molding of plastic compounds at its best! Two telephone housings per cycle . . . a 17 ounce shot . . . metal inserts, heavy bosses, variable sections, undercuts, accurately spaced ribs. Good finish is a must! Sinks and weld lines can't be tolerated.

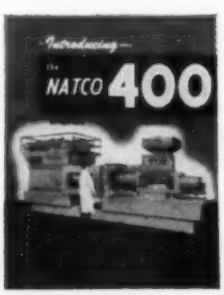
Yes, it's got to be right at Western Electric and the Natco 400 does the job. Why not investigate what it will do for you? Regardless of your molding application, a new Natco will do a smoother and better job. Dependable operation is part of Natco's basic design. Get the facts first hand. Machine sizes range from 12 to 85 ounces. Write for complete information.



NATCO

PLASTICS MACHINERY DIVISION

Ask for free copy of Bulletin 4001 describing the new Natco 400.



National Automatic Tool Co., Inc. Richmond, Indiana

FOR OVER FIFTY YEARS, DESIGNERS AND BUILDERS OF AUTOMATIC PRODUCTION MACHINERY



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STRENGTH . . ."Mylar" is the strongest of all plastic films. Instron tester shows an average strength of 20,000 lbs. psi.



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ABRASION RESISTANCE. Tests on commercial abrading equipment prove the remarkable wear resistance of "Mylar" film.

Core binder tape made with Du Pont MYLAR® helps Western Electric speed production of communication cable

PROBLEM: Western Electric's new long-life, high-dielectric communications cable posed a challenging problem for production engineers. The problem was this—how to efficiently extrude an outer jacket of polyethylene without fusing the inner pairs of wires also coated with polyethylene.

SOLUTION: After extensive tests with combinations of materials, a tape of Du Pont "Mylar"* polyester film and rubber was selected to act as a heat barrier.

RESULTS: Western Electric reports that abrasion-resistant "Mylar", with its hard, durable surface, helps the core binder tape run smoothly on its equipment without snagging or tearing. Because of its high tensile strength and melting point, "Mylar" helps prevent corrugations of the electrostatic aluminum shield from breaking through the tape and shorting the cable.

HOW CAN "MYLAR" HELP YOU? Whether you make guided missiles or tiny components, you may be able to capitalize on the outstanding combination of properties found in tough, transparent "Mylar" film. For a booklet containing technical data plus information on successful applications, send in the coupon below.

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*"**MYLAR**" *is Du Pont's registered trademark for its brand of polyester film.*



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Film Dept., Room M-1, Nemours Bldg., Wilmington 98, Del.

Please send the new booklet listing properties, applications and types of "Mylar" polyester film available (MB-11).

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Company_____

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Engineered by Tinnerman...

On the assembly line...and in the field plug-in **SPEED CLIPS**® simplify rectifier installation

At General Electric, two variations on a single SPEED NUT® principle are being used to make things easier for production-line assemblers and for electronics servicemen.

The basic idea of the Tinnerman front-mounting SPEED CLIP is incorporated into the sockets of GE germanium rectifiers made by GE's Semiconductor Products Department, Syracuse, for industrial electronics applications.

On the TV production line, the Tinnerman SPEED CLIP permits rapid, tight, and simple installation of rectifiers. In the field, merely by unplugging the original equipment rectifier and plugging in its germanium replacement, the serviceman can quickly get a unit back in service.

Working together, General Electric and Tinnerman engineers developed the two types of SPEED NUT parts that are fabricated right into the rectifier shells.

Unusual applications of the SPEED NUT principles to scores of different products are developed every day at Tinnerman. That's why over 9,000 different forms of SPEED NUT Brand Fasteners have been designed for all leading manufacturers.

Your fastener problem can probably be solved quickly by a call to your Tinnerman sales representative. If his name isn't in your telephone directory, write to:

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CANADA: Dominion Fasteners Ltd., Hamilton, Ontario. GREAT BRITAIN: Simmonds Aerocessories Ltd., Treforest, Wales. FRANCE: Simmonds S. A., 3 rue Salomon de Rothschild, Suresnes (Seine). GERMANY: Mecano-Bundy GmbH, Heidelberg.



Goodyear Aircraft Corporation specifies "SCOTCHPLY" Reinforced Plastic

...for Air Force 26½ foot rigid radome

Air Force design and specifications were clear: Material for this rigid radome must meet precise electrical requirements in addition to being structurally strong, lightweight and with high modulus. That's why Goodyear Aircraft Corporation recommended "SCOTCHPLY" Brand Reinforced Plastic.

Goodyear knew the "SCOTCHPLY" Reinforced Plastic story. They knew that the tremendous flexural modulus and strength of "SCOTCHPLY" Reinforced Plastic would enable them to construct a superior 26½ foot radome—one which would eliminate bulky trusswork previously utilized in rigid radomes of comparable size. They knew that the elimination of this bulky trusswork would minimize radar interference and result in greatly improved transmission efficiency.

Goodyear—and "SCOTCHPLY" Reinforced Plastic—got the job.

"SCOTCHPLY" Reinforced Plastic is a high-strength, moldable, laminated structural plastic reinforced with *continuous, non-woven* glass filaments. These reinforcing filaments can be accurately oriented to meet specific stress requirements. For example, at 70° F., unidirectional "SCOTCHPLY" Reinforced Plastic has a flexural strength of 130,000 psi and a flexural modulus of 5.3×10^6 psi. For complete information on this remarkable new material and what it can do for you, write 3M, Dept. PY-28, St. Paul, Minn.

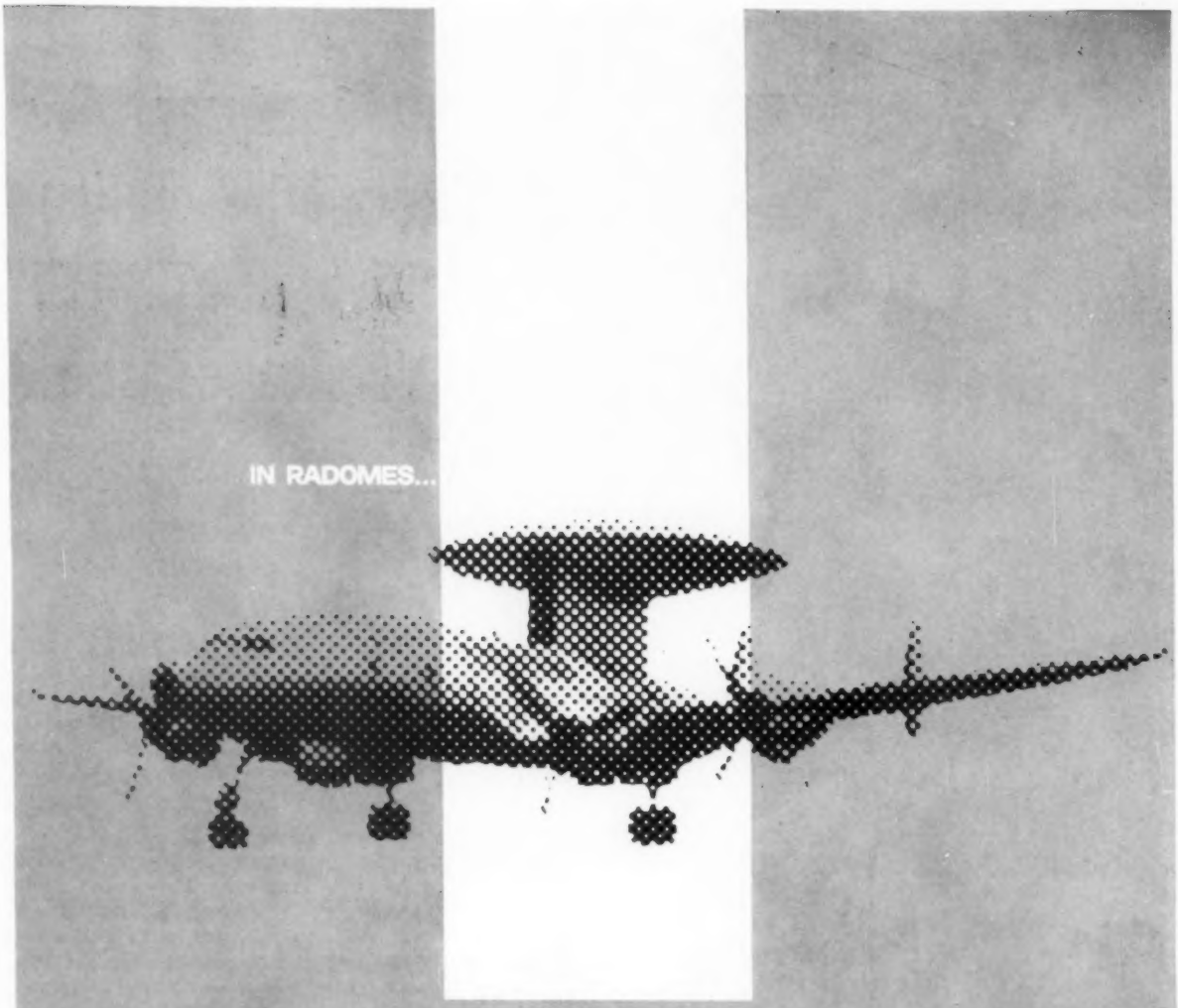
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SCOTCHPLY Reinforced Plastic

BRAND

THE TERM "SCOTCHPLY" IS A REGISTERED TRADEMARK OF MINNESOTA MINING AND MANUFACTURING COMPANY, ST. PAUL 6, MINN. EXPORT SALES OFFICE: 99 PARK AVE., NEW YORK 16, N.Y. IN CANADA: P.O. BOX 757, LONDON, ONTARIO.

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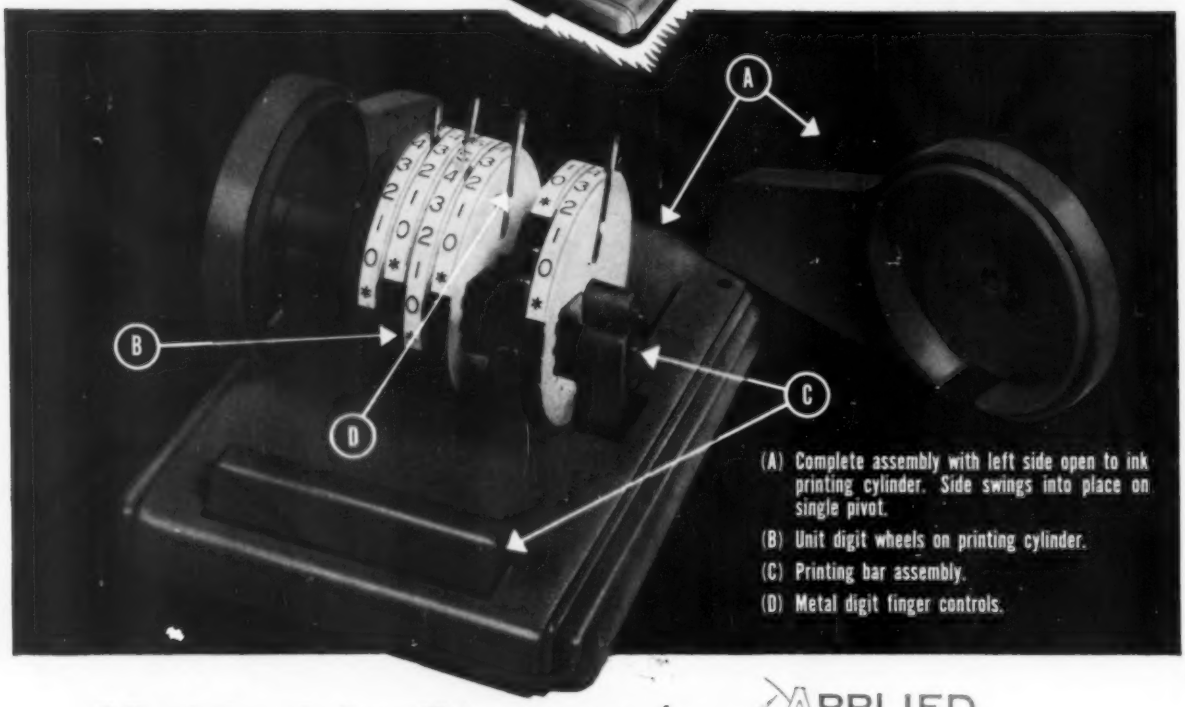
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Again a Quinn-Berry achievement in an unusual molded plastic application . . . proving, of course, that at Quinn-Berry the "Unusual is Routine."



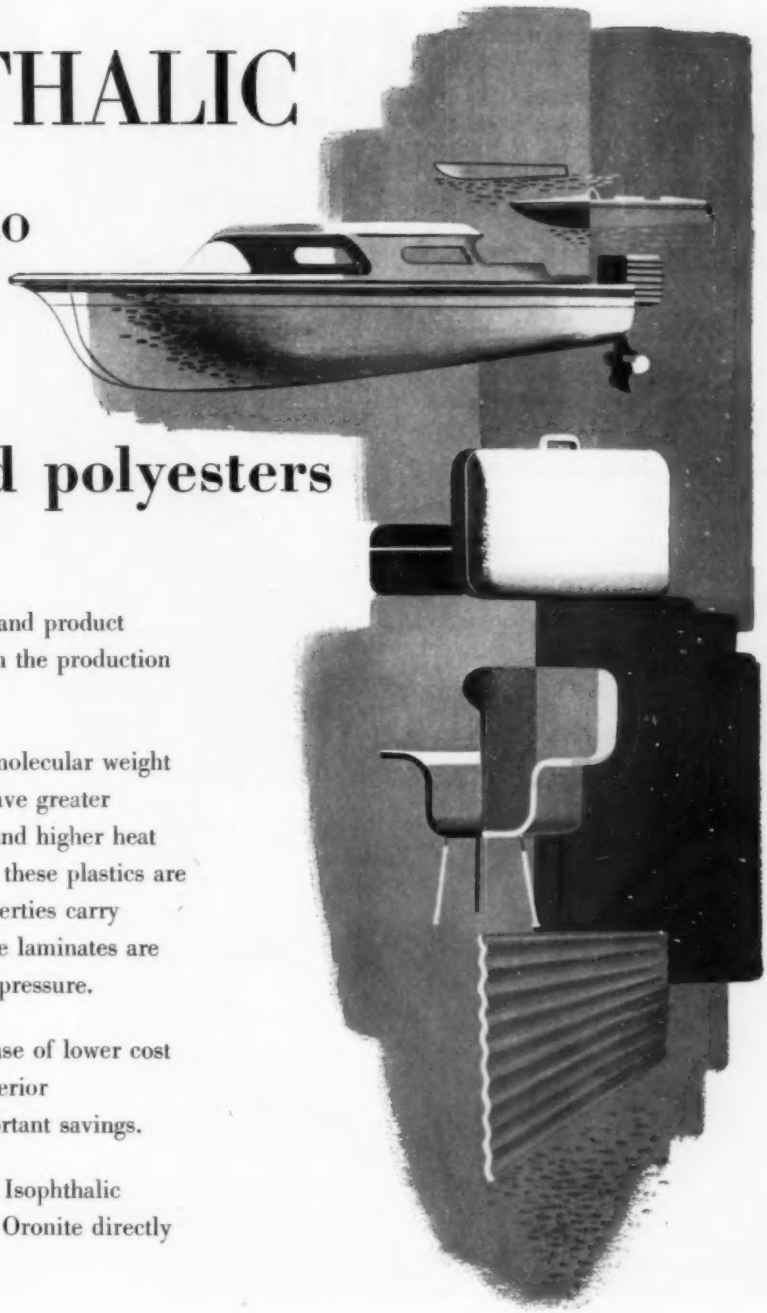
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Discover for yourself the cost and product advantages Isophthalic offers in the production of reinforced plastics.

You can now produce higher molecular weight products which are tougher, have greater flexural and impact strengths and higher heat distortion temperatures. When these plastics are reinforced with glass, the properties carry over into the laminates and the laminates are resistant to water erosion and pressure.

Isophthalic resins permit the use of lower cost raw materials to give you superior unsaturated polyesters at important savings.

Ask your resin supplier about Isophthalic based formulations—or, write Oronite directly for further information.

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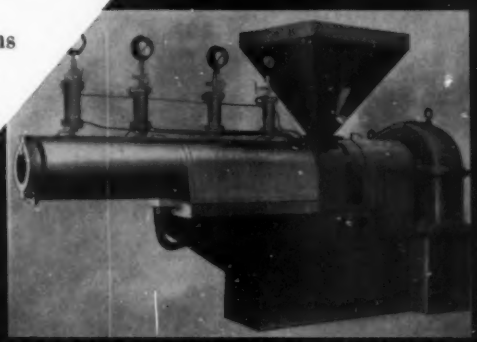
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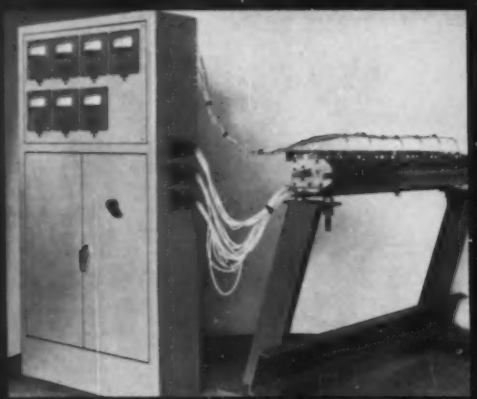
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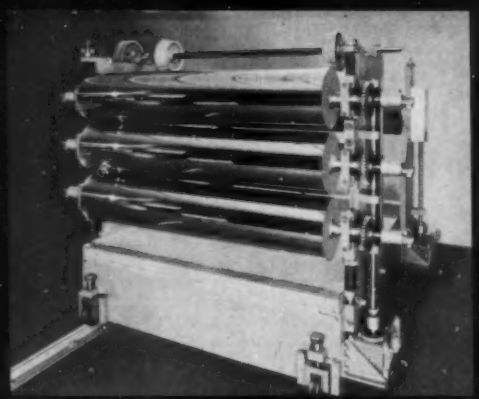
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Consult your nearest IC Polyester specialist for facts about specific hand lay-up fabrication problems, or write for the new IC Hand Lay-Up Bulletin.

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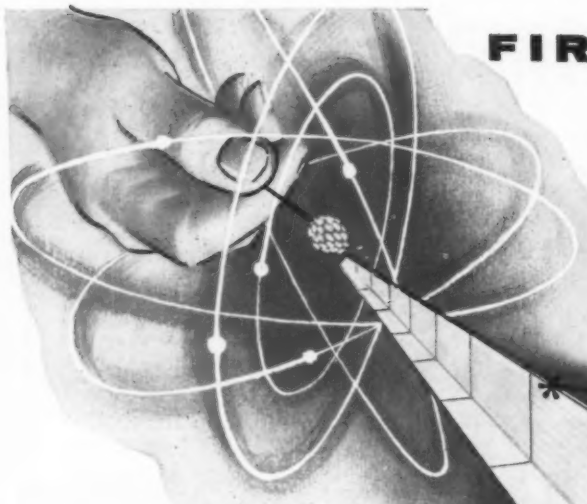
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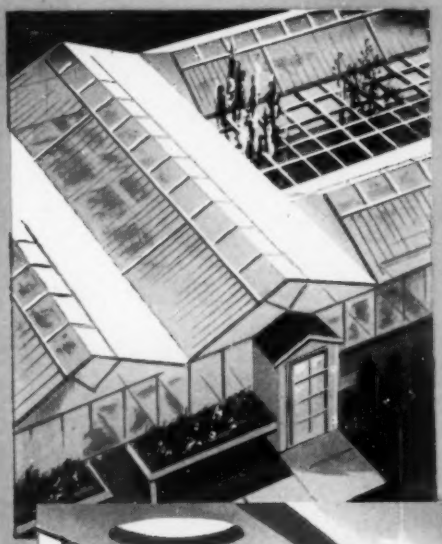
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SELECTRON Resins offer almost endless possibilities to alert, progressive manufacturers. If you are designing a new product—or redesigning one you are now making—SELECTRON may help you make it lighter, stronger, more durable and, probably, at lower cost. We'd be glad to have one of our engineers discuss your problems with you without cost or obligation.

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High polish was the No. I requirement ...so the choice was Lustre-Die

The job sounded simple enough—turning out a plastic injection mold which would be capable of producing decorative bowl bases made of polystyrene plastic. But because the finished pieces were later to be silver-plated, it was imperative that the mold have the ability to take an unusually high polish.

We proposed Lustre-Die tool steel for two reasons. We were sure that, because of its properties and cleanliness, Lustre-Die would meet the polish requirements with plenty to spare. It was also logical to assume that it would save time in the shop, because of its easy machinability. The die-maker, Interstate Mold & Hobbing Co., Union, N. J., reported that the mold performed to their satisfaction on both counts.

Lustre-Die is an ideal tool steel for making plastic parts, primarily because its properties enable it to take such an unusually high polish. Lustre-Die is so bright-looking that it provides virtually the same effect as looking in a mirror.

Lustre-Die is the proper analysis for forming plastics, and is further enhanced by alloy fortification. It is heat-treated by oil-quenching and tempering to augment its properties. It comes ready for machining and polishing, ready to go to work. Lustre-Die steel is made in the electric furnace, and is carefully inspected to insure cleanliness. It is free from injurious porosity or surface pitting. Moreover, there's no need to be concerned about inclusion-causing additions.

If you would like to give Lustre-Die a trial run, get in touch with your Bethlehem tool steel distributor. He has Lustre-Die in stock, and can get it to you quickly.

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BETHLEHEM, PA.

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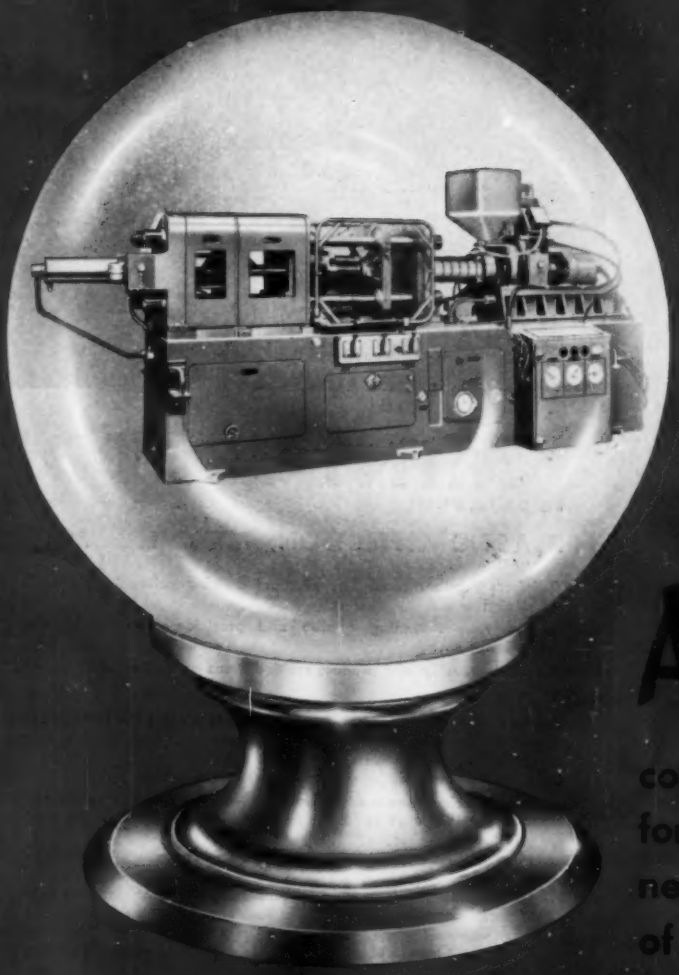
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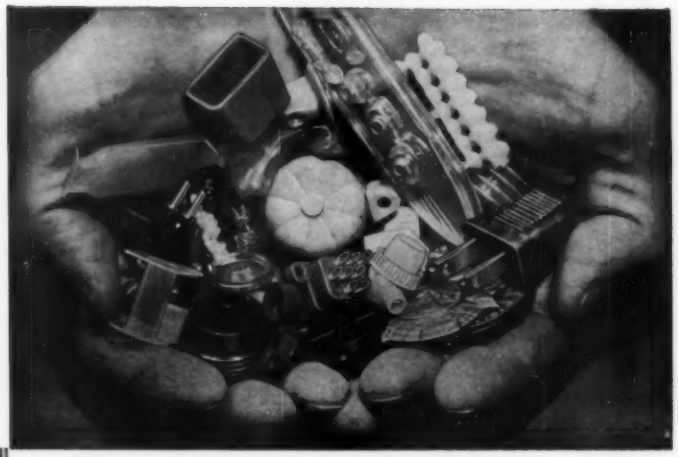
Illustrated literature available on request.

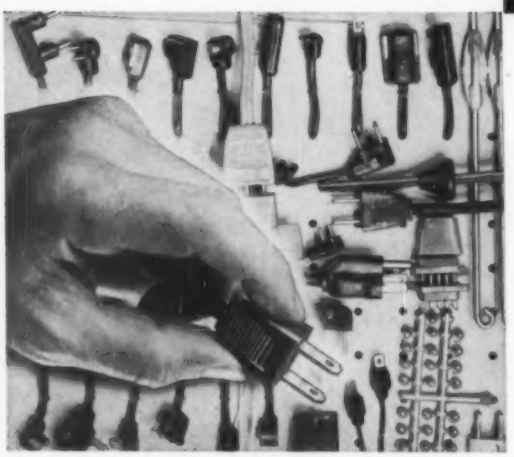
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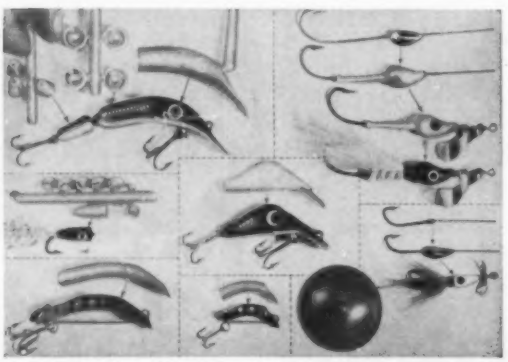
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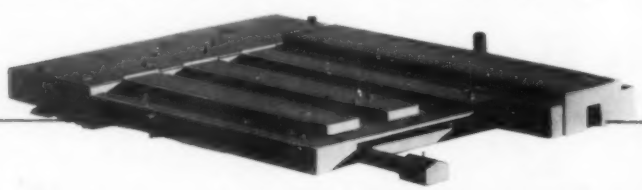
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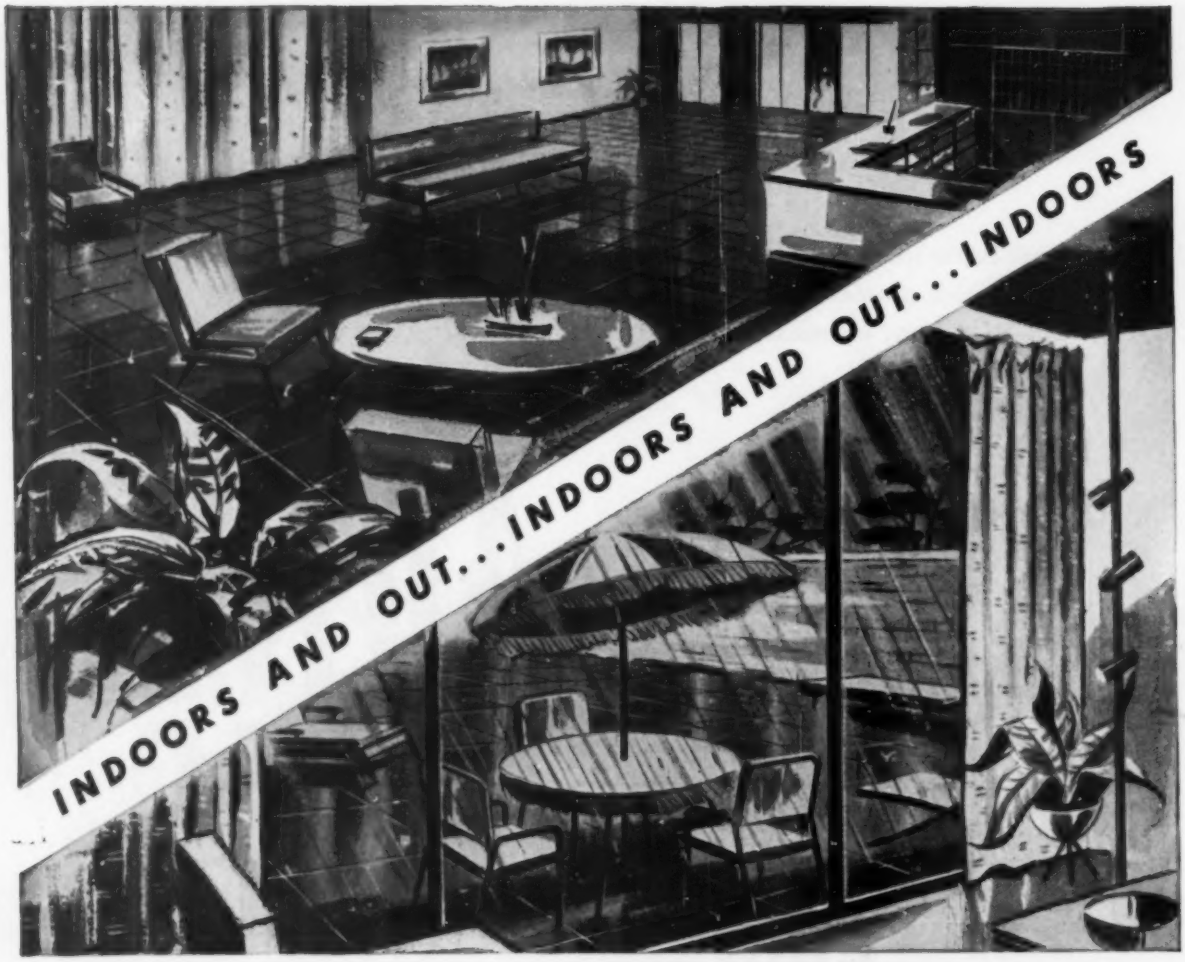
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MODERN PLASTICS

Volume 35
February
1958
Number 6

Don't miss...

The second in our series of covers. Since February is traditionally the month in which the great S.P.I. Reinforced Plastics Conference is held, and since that Division of the industry is making such great progress at this time, artist Robert Hallock emphasizes the components used in reinforced plastics and the important applications of the resulting materials.

The story behind the boom in plastics boats. From a standing start only a decade ago, the reinforced plastics boat building industry produced over 50,000 units in 1957 and this year is geared up to make 75,000 units. Method of manufacture depends on the size and type of boat, and shown here are the three main methods of production.



Now, in addition to reinforced plastics, ABS thermoplastic sandwiches enter the field in drape formed boats, outboard motor housings turn to plastics, nylon hardware replaces metal, the new foams move into the picture as economic flotation materials, and even propellers are being made out of plastics. See "Plastics Ahoy!" p. 87.

The implications in continuous extrusion-thermoforming. This has been the subject of engineering and cost argument over the past three years. Here for the first time is a close look at a highly automated line producing large pieces efficiently. See "Automated extrusion-thermoforming," p. 104.

At last! Plastics shell cases. In order to save weight and strategic metals, the Navy Ordnance Laboratory has pioneered for the U. S. Army an injection molded ABS plastic shell case for 105-mm. howitzers. Tests are successful to date and pilot plant production has been ordered for operational and cost studies. All the information presently available is presented in "ABS joins the artillery." See p. 96.



Important information on thermoset shrinkage. An extension of work published earlier, this, the first of a series of two articles, reports an investigation into the causes and the possible cures of shrinkage in compression moldings. See "Molding shrinkage," p. 125.

A revolutionary design in melamine, and a tremendous achievement in mold design is the new Waring Drink Mixer. The mixer has a body molded in one piece with integral mixing cavity, motor housing, pitcher handle, pouring spout, mounting bosses, and plug receptacle. This could mean a breakthrough for plastics in the small motorized appliance field. See "Melamine makes a mixer," p. 98.



Report on the S.P.I. Vinyl Conference. A penetrating analysis of the price-profit squeeze in finished vinyl goods, a look at the present plasticizer situation, a discussion of rigid sheet. Read "Vinyl film meeting—1957," p. 234.

A great innovation in making reinforced plastics parts. Called one of the most important developments since fibrous glass was invented, the "sprayup" method of applying fiber and resin to a mold may offer big cost reductions on short and medium runs, and should open up many new fields. See "Reinforced plastics by 'sprayup,' " p. 119.



An all-nylon spray gun body. The single molded unit replaces three metal parts, eliminating machining, polishing, plating, and assembly problems. It is one-third the weight of the model it replaces, is easier to clean and easier to handle. See p. 101.

Watch for... more exciting covers as listed in this space last month . . . a thorough coverage of NEW applications of plastics in the electronics field . . . a review of new developments in electronic heat sealing . . . a series of articles on plastics pipe . . . new applications and methods for fabricating vinyl-metal laminates . . . how to mold linear polyethylene . . . a survey of markets for polypropylene . . . the story of plastics in tarpaulins, airhouses, etc. . . . a major feature on high-heat-resistant plastics . . . an analysis of potentials in reinforced thermoplastics . . . the introduction of rotationally castable polyethylenes . . . new developments in vinyl laminates . . . an article on wood-filled urea and its possibilities . . . and continuing detailed information on new materials and methods you can use for profit!







PLASTICS AHOY!

From dinghies to landing craft, from runabouts to sloops, the plastics boat business is booming . . . Here's why

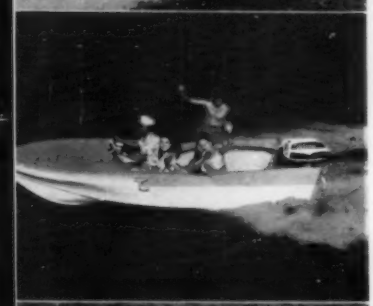
Of all the applications for reinforced plastics, boat construction is probably the most logical. That's part of the reason why reinforced plastics are so firmly entrenched in the field today, even though the total history of plastics boats spans only ten years.

Polyester resin reinforced with fibrous glass accounts for 18 to 20% of the total outboard boat market at present, and the material is plainly destined to become the basic building stock of all types of boats except large commercial ships. Whereas reinforced plastics boats were little more than a novelty until 1954, the real year of their arrival, wood boats may be the novelty in the near future.

Here are the figures: in the seven-year period between 1946 and 1953, only about 4000 RP boats were manufactured. The break-















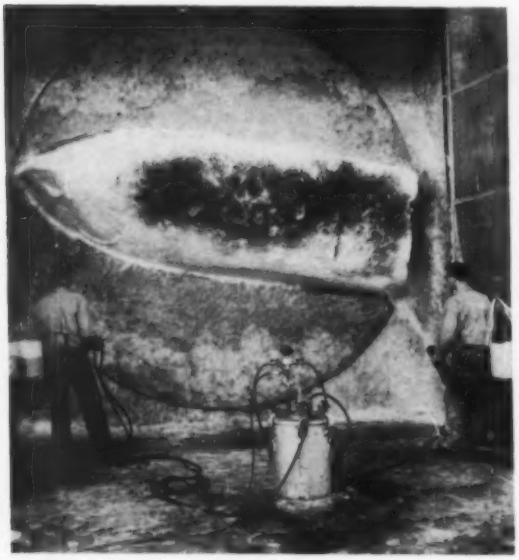




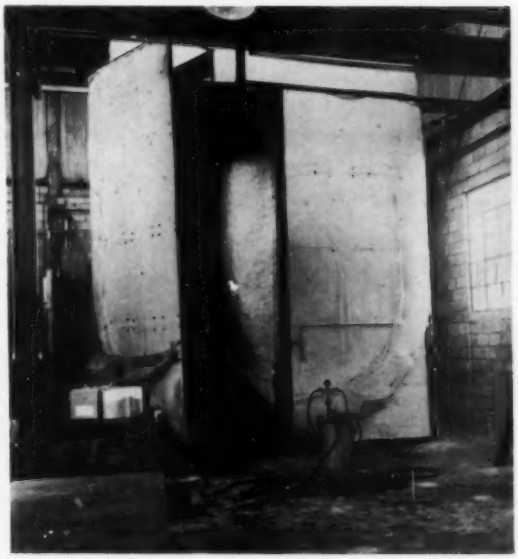


1, 5, 12—Lone Star Boat Co., Grand Prairie, Texas; 2—Wizard Boats, Inc., Costa Mesa, Calif.; 3—The Anchorage, Inc., Warren, R. I.; 4—Coleman Boat and Plastics Co., Sausalito, Calif.; 6, 10, 11, 13—Dorsett Plastic Corp., Santa Clara, Calif.; 7—Plastic Fabrications, Inc., Miami, Fla.; 8—Glasspar Co., Santa Ana, Calif.; 9—Molded Fiber Glass Boat Co., Union City, Pa.

PRESS MOLDED LAP STRAKE



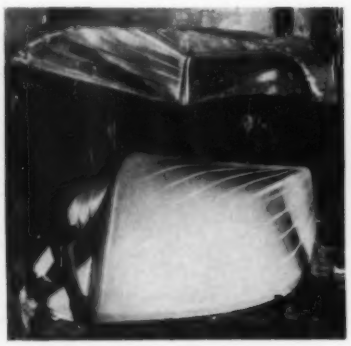
1 **Chopped** roving and polyester resin binder are sprayed onto preform at Molded Fiber Glass Co. plant



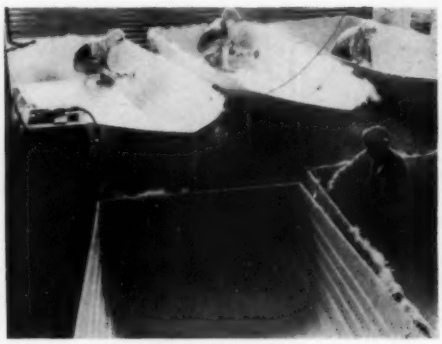
2 **Doors** of preform room are closed for partial cure before moving layup



3 **Preform** is put on press and polyester poured on prior to molding



4 **Molded** boat hull is removed from press



5 **Flash** is removed and molded hulls sanded

through came in 1954, when production jumped to 16,000 units. Two years later it was 40,000. The 1957 total, according to an estimate by Owens-Corning Fiberglas Corp., major fibrous glass supplier and godfather of the reinforced plastics boat, will be 55 to 60,000 units. This is out of a probable 1957 U. S. market of 400,000 small craft; the National Association of Engine and Boat Manufacturers reported 1957 sales of 320,000 outboard boats alone.

So, the tide has turned. For 1958, Boughton Cobb Jr., manager of marine sales for Owens-Corning, envisions sales of 70 to 75,000 reinforced plastics boats, and from there to "a clear preemption of the market—60 to 70% —within five years."

Of course, other types of plastics construction may also cut into this market, but wood and metal, the materials that have dominated boat construction since man first ventured out on the water, look as though they can offer only weak resistance to the broad invasion of reinforced plastics.

The quality that separates plastics craft from all others is their well known ease of maintenance. The annual scraping, sanding, caulking, and painting party so familiar to yachtsmen is not necessary with a plastic boat. Seamless hulls have no nails, screws, or rivets to work

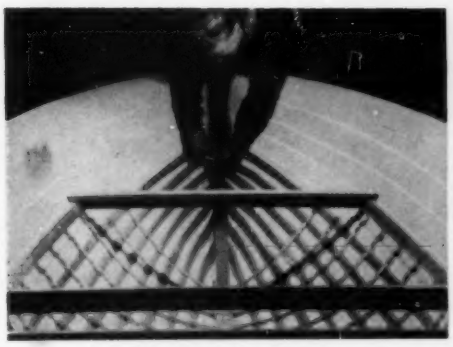
loose; they hold up under severe weather conditions, do not have to be hauled out of the water after the season; they do not rust, corrode, or rot; and they are impervious to marine borers. In the water, they're lighter and faster because they don't soak up a good part of their weight in water.

Best material available

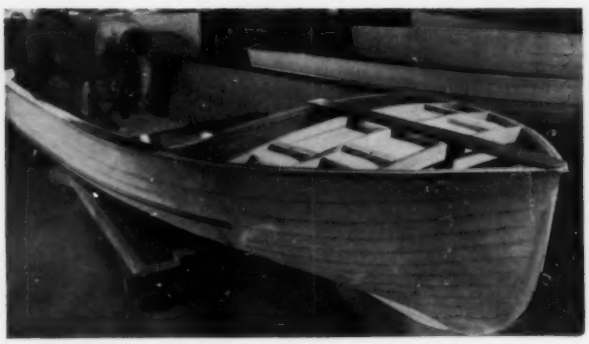
The sum total of these qualities is enough to make reinforced plastics the best material available for boat building. Even at that, this total is not enough to make these boats the panacea for all nautical ills envisioned by manufacturers in the early days. The boats do have to be painted occasionally. Color pigments in the resin fade after a few years; in salt water it is necessary to use anti-fouling bottom paint to prevent barnacles and other marine growth from accumulating. Plastics boats are often more expensive to manufacture (except in craft over 25 ft.) because of higher cost of raw materials, though strides are being made in this direction, especially with hulls formed with one squeeze of matched molds.

Reinforced plastics boats will burn—with about the same intensity as plywood—unless flame-resistant resins, such as Hooker Electrochemical Co.'s Hetron, are employed; and these resins command a premium price. Further, there's no guarantee of a good product just because polyester and glass are employed. The same painstaking attention to design and detail that has always been necessary with wood and metal must be put into a plastics craft.

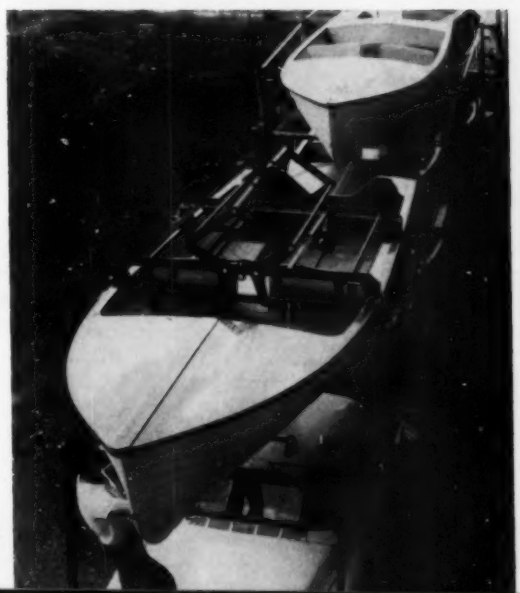
As the 1957 production figures indicate, plastics will take a sizable chunk of the boat business. Today there are over 150 firms building these craft. They use 25.2 million lb. of reinforced plastics a year, according to the Reinforced Plastics Div. of S.P.I. This figure also



6 **Strands** of roving, dipped in polyester, are installed to reinforce hull at critical points. Worker in photo tightens stem brace



7 **Foamed styrene,** to act as flotation material, is installed under deck of boat



8 **Finished 15-ft.** runabouts leave plant, ready for the water. (Photos, Owens-Corning Fiberglas Co.)

includes the covering kits sold to give new life to soggy and ailing old wooden boats. Altogether, the marine field uses 15% of all reinforced plastics sold.

Other plastics materials

In addition to reinforced plastics, other plastics materials are getting solidly entrenched in the $2 billion boat field. Acrylic windshields, pushed by Rohm & Haas, are standard equipment on thousands of boats; ornaments and functional parts of the same material are becoming more popular. Cadillac Plastic & Chemical Co., Detroit, Mich., has cultivated this market with good success.

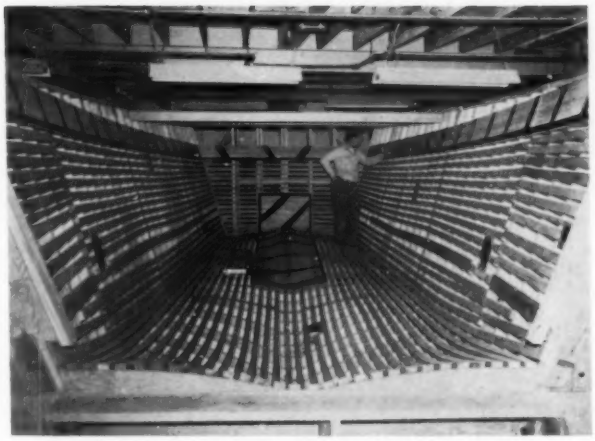
Nylon hardware, with Du Pont behind it, offers the same maintenance-free virtues as reinforced plastics, and is becoming of more interest to boat owners every day. A company specializing in nylon hardware—Danielson Mfg. Co., Danielson, Conn.—recently dramatized the strength of its injection molded fittings by lifting a good-sized outboard out of the water by its hardware in a tour de force demonstration. Nylon propellers have also made their appearance and look like a sure bet to catch on volume-wise, although they take a big slug of expensive material per unit.

Butyrate, with good impact and weather resistance, and the flexibility to bend around hull curves, is a leading material for identifying letters and numerals in marine applications. Polyethylene is in the field in the form of boat and motor covers, as well as for marine cable; and vinyl upholstery can be found everywhere.

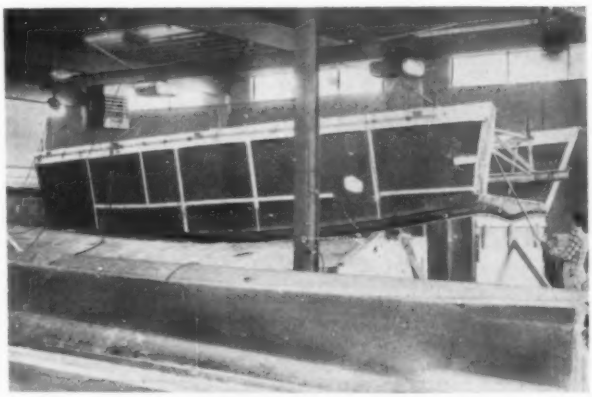
Foamed styrene, having established supremacy as the leading marine flotation material, is now getting a run for its money from urethane foam, which offers much greater convenience for foaming-in-place. Allied Chemical & Dye has been actively promoting its Nacconate isocyanates for this application. (See pictures, p. 95.) In a recent announcement, the Electric Boat Div. of General Dynamics Corp., Groton, Conn., said it was using urethane foam in the new atomic submarine *Skipjack* in place of pine and pitch conventionally used to fill cavities. The urethane foam will lighten the sub by several tons; it has elastic memory and, unlike pine, regains its shape after being subjected to heavy pressures.

Of the 6.6 million lb. of marine cordage sold last year, 1.65 million were synthetic—with nylon and polyethylene the leading materials.

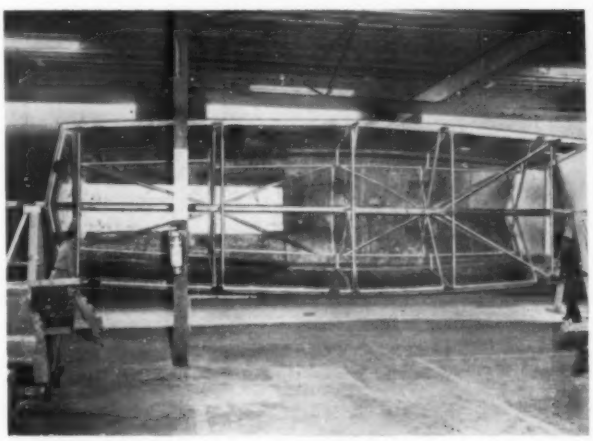
The plastics boat business for the most part follows the "horizontal" nature of the industry



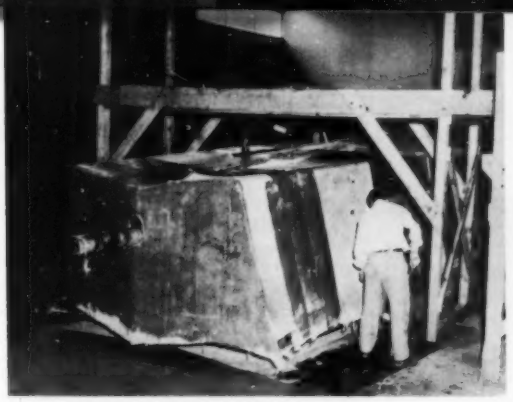
1 **Mold** for 36-ft. LCVP, with sides in place, at Lunn Laminates plant



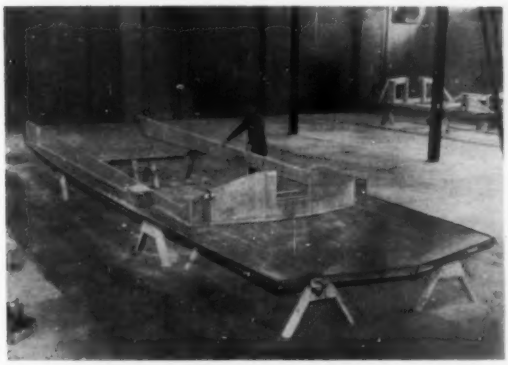
2 **Section** of hull, with 3-in. honeycomb core and inside polyester-glass skin complete, is lifted out of mold



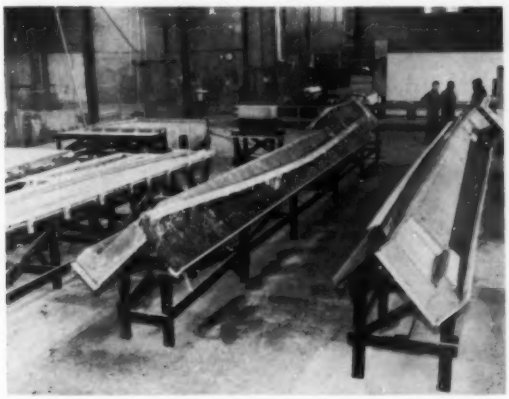
3 **Hull** is turned over by means of jig specially developed for this job



4 **Outside** skin of glass cloth and polyester resin is laid up on hull



5 **Top deck** of LCVP consists of a large one-piece molding



6 **Side** decks of LCVP are laid up in one piece in female molds

—a multitude of small firms making a few boats, often on a custom basis, and serving a neighboring radius of 500 miles. Generally speaking, boat companies are privately owned, undercapitalized, and highly resistant to change. If this were not the case, reinforced plastics, a patently superior material, would have scored even bigger gains—and faster.

The same inertia to anything new somewhat characterizes many boat users. As boys they dreamed about wooden boats with shiny mahogany decks; the fearsome maintenance required is a ritual to them, part of the game, a chore to be cherished. This partly explains why anyone still buys—and will continue to buy—a wooden boat. But these factors cannot offset the advantages of the plastics boat.

From 6 to 40 feet

Every boat builder of any size in the country is either now producing or planning to produce at least one reinforced plastics model. They range from lowly 6-ft. dinghies to top-bracket 40-ft. auxiliary sailboats. At the 1957 Chicago boat show, 170 models, or about 23% of the 740 exhibited, were plastics; at the New York exposition the score was 81 plastic boats, or about 18% of the 448 exhibited.

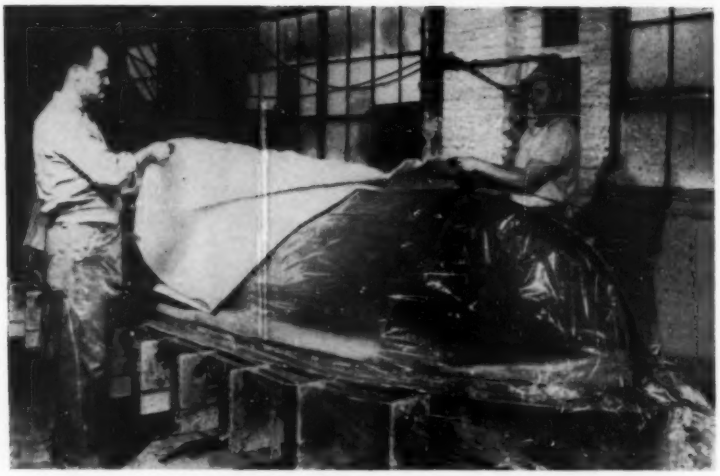
Many of the old-guard wooden boat yards have switched over completely to plastics. A typical company is the 58-year-old Cape Cod Shipbuilding Co., Wareham, Mass., with models from a small dinghy to a 24-ft. sloop, and The Ankorage, Inc., Warren, R. I., another full-line builder that changed over to reinforced plastics in 1950.

Recently one of the biggest holdouts from reinforced plastics construction got its feet wet: Owens Yacht Co., Baltimore, Md. This company, a powerhouse in the pleasure craft field, is bringing out a medium-sized plastics runabout aimed at the economic heart of the industry. And a large aluminum boat builder

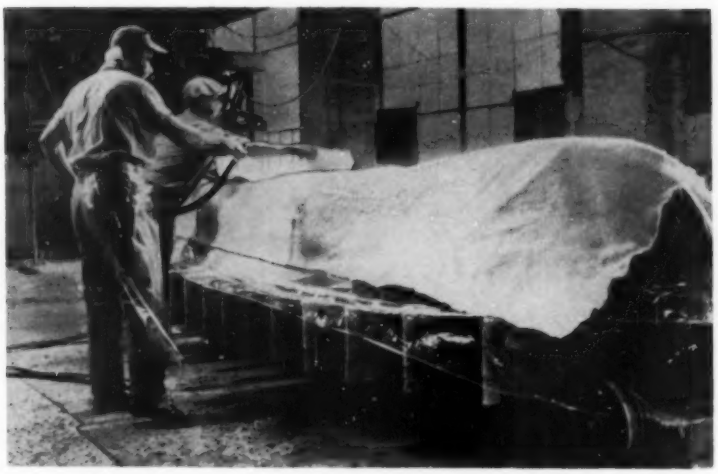


7 **LCVP** is tested in water after craft is completed. One of these boats has survived 2000 test landings in good shape. (Photos, Lunn)

BLADDER MOLDED SPORTS BOAT



1 **Rubber bladder,** which serves as the form for the inside of Winner Manufacturing's boat hull, is covered with PVA parting film; then glass mat is laid up



2 **Polyester** resin is sprayed onto each layer of mat. Workman in background is laying up second layer

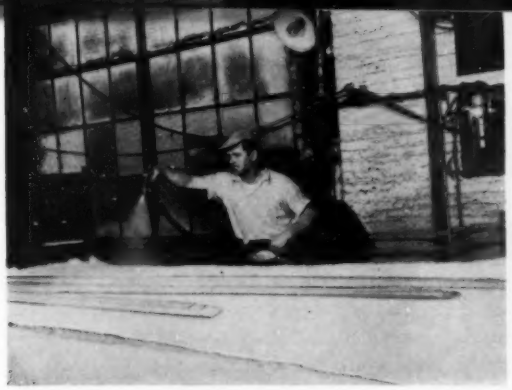
in Minneapolis has brought out a high-styled plastics outboard: when a firm named *Aluma* Craft Boat Co. offers a *plastics* boat, the handwriting's really on the hull.

But even more indicative of the growing importance of plastics boats are the heights of commercial success newly reached by a handful of large-scale builders such as Lone Star Boat Co., Grand Prairie, Texas, Molded Fiber Glass Boat Co., Union City, Pa., Winner Mfg. Co., Trenton, N. J., and a trio of firms on the West Coast—Glasspar Co., Wizard Boats, Inc., and U. S. Fiberglas Co.

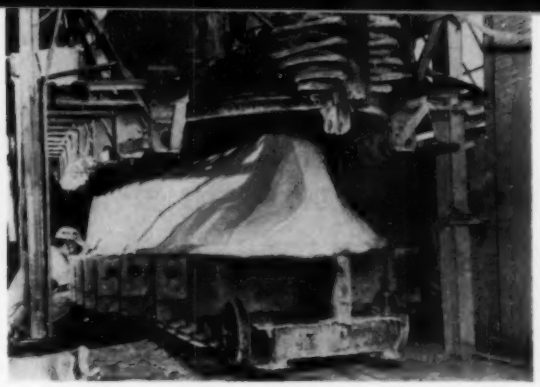
The companies all specialize in production of outboard runabouts, the 12- to 16-ft. craft that account for some 80% of the U. S. boat market. Putting it another way, one firm manufacturing six handsome models ranging from 15 to 17 ft.—Peninsular Fiberglass Products, Inc., Hialeah, Fla.—feels it can satisfy the wants of 90% of all boat buyers within this 2-ft. range.

Materials used

The type of polyester used in constructing reinforced plastics boats is a general-purpose, rigid laminating resin that has been mixed with



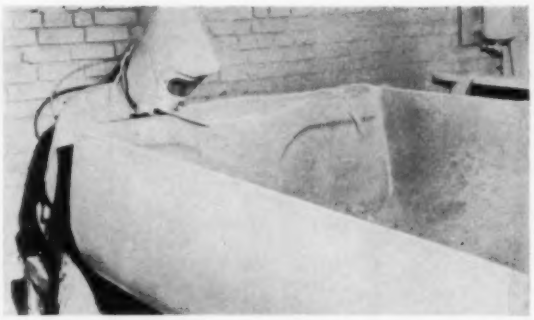
3 **Shaped plywood** stringers, shown in place on layup, are molded into hull to provide added rigidity to craft



4 **Completed** layup of sports boat is rolled into place under top half of mold



5 **Molded hull** is removed from mold after having been cured under heat and pressure



6 **Flash** is removed from edge of newly molded hull by workman wearing respirator hood



7 **Seats** and wooden strip are installed in hull. Strip is covered with polyester-glass gunwale



8 **Completed** boat weighs 360 lb., is 14¼ ft. long. Craft seats five comfortably. (Photos, Winner)

a suitable hardener. There are no less than 28 producers of polyester resins; the ones most often mentioned by boat builders that were interviewed in the preparation of this article include the following:

American Cyanamid Co., New York, N.Y.; Barrett Div., Allied Chemical & Dye Corp., New York, N.Y.; Chemical Products Div., Archer-Daniels-Midland Co., Newark, N.J.; Celanese Corp. of America, Newark, N.J.; Cordo Chemical Corp., Norwalk, Conn.; Durez Plastics Div., Hooker Electrochemical Co., N. Tonawanda, N.Y.; Chemical Div., General Tire & Rubber Co., Akron, Ohio; Glidden Co., Cleveland, Ohio; Naugatuck Chemical Div., U.S. Rubber Co., Naugatuck, Conn.; Pittsburgh Plate Glass Co., Pittsburgh, Pa.; Reichhold Chemicals, Inc., White Plains, N.Y.; Rohm & Haas Co., Philadelphia, Pa.; and Witco Chemical Co., New York, N.Y. A complete list of polyester suppliers will be found on p. 1037 ff. of the 1957 MODERN PLASTICS Encyclopedia issue.

Besides polyester resins, the epoxies are getting considerable attention from the marine field. Though the material is discouragingly ex-

DRAPE FORMED ABS BOAT



Runabout made by U. S. Rubber consists of a sandwich construction of cellular ABS laminated to ABS (see inset). Hull and deck (including seats) are each formed in one piece in a single operation. (Photo, U. S. Rubber)

pensive for use in hull construction, its excellent adhesion to glass filaments and its fatigue characteristics and high strengths are commanding attention. Epoxies are already being used as adhesives and for building female molds for boat hulls; other uses are anticipated in the not-too-distant future.

Three different forms of fibrous glass are used by boat builders: woven cloth, woven roving, and chopped-strand mat. The choice depends on cost, production method, and structural strength desired. Besides Owens-Corning, fibrous glass is supplied by Bigelow Fiber Glass Products, New York, N.Y.; Ferro Corp., Nashville, Tenn.; Hess Goldsmith & Co., New York, N.Y.; L-O-F Glass Fibers Co., Toledo, Ohio; United Merchants Industrial Fabrics, New York, N.Y.; Modiglass Fibers, Inc., New York, N.Y.; and Fiber Glass Div., Pittsburgh Plate Glass Co.

Production methods

The main molding method employed by reinforced plastics boat builders is the contact technique or variations thereof. Bag molding is also used and two practitioners of the art of matched metal molding are Goodyear Aircraft Corp., Akron, Ohio, and Molded Fiber Glass Boat Co. Goodyear forms hulls alone and ships them for completion to Bowman Manufacturers, Inc., a big Little Rock, Ark., firm that also sells aluminum boats.

Largest seller of its size

Molded Fiber Glass Boat Co. is a sister firm of Molded Fiber Glass Body Co. which manufactures the bodies for the Chevrolet Corvette. Robert Morrison, president of the Molded Fiber Glass complex, pushed out over 5000 15-ft. outboard runabouts in 1957, making it the largest selling boat of its size in the world.

1 **Acrylic** windshields in sweeping panoramic styles are becoming increasingly popular in marine field

2 **Ornaments** of acrylic, in bronze and chrome tones, are also taking hold. (Photos, Cadillac Plastic & Chemical)





The boat comes in three different models, all of which use the same hull. Mr. Morrison expects to manufacture 6000 of these boats next year and has just put a new basic hull into production: a 12½-ft. outboard to sell for considerably less than the 15 footer and tap a different market. The tag on the lowest-priced Corry, an open fishing boat with three full-width seats, is under all competition at $295, and the sales goal is over-all competition at 5000 units the first year.

The production method developed by Molded Fiber Glass, the same as used to produce the Corvette body, is briefly this: chopped glass roving and binder resin are sprayed onto a revolving preformer, then given a quick partial cure. (See photos, p. 88.) Next the preform is positioned in the molding press, a measured amount of polyester resin poured over it, and the press closed for a 700-ton squeeze at 230° F.

When the press opens, minutes later, a completely cured hull has been produced. The bare hull is reinforced by strands of roving dipped in polyester which are simply laid in place to form longitudinal and lateral ribs. Then the boat is ready for keel, decks, etc. The company ships out a boat complete to the last detail, including installation of all the necessary hardware.

Winner, manufacturer and aggressive merchandiser of a full line of 12 highly styled outboards ranging from 12 to 19 ft., is a specialist in the bag molding technique. Under this system, the hull is built up over an inflated rubber bladder. After the hand layup is thoroughly impregnated with polyester resin, it is placed under the female mold and the bladder forces the layup firmly against the mold, where the hull is cured under heat and pressure. (See photos, pp. 92-93.) I. M. Scott, (*To page* 210)

NEW FLOTATION FOAM

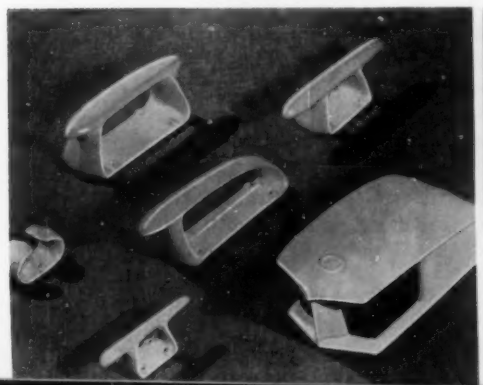


Urethane foam, a new contender for the buoyancy market, starts foaming the instant ingredients are mixed together

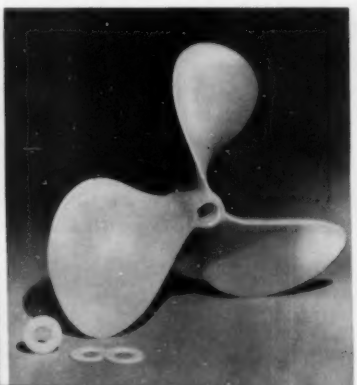


Cavities anywhere on a boat can be filled with urethane, which bonds to hull walls. Above, workman cuts off excess foam prior to installing deck of a fishing boat. (Photos, Allied Chemical & Dye Corp.)

3 **Nylon** hardware, which will not rust or corrode, finds growing acceptance for boats. (Photo, Danielson Mfg. Co.)



4 **Propellers** of nylon are making headway, despite high material cost. Below is 18-in. propeller with 2-in. washers. (Photo, The Polymer Corp.)



5 **Butyrate** letters that won't peel off or rust are now standard in marine usage. (Photo, Eastman Chemical)



ABS joins the artillery

Injection molded shell cases for 105-mm. howitzers have been successfully tested and pilot plant production has been ordered for operational and cost studies. They save weight and strategic metals



Several advantages of ABS copolymer artillery shell cases are illustrated in photo. At right, NOL scientist S. P. Prosen demonstrates their flexibility. Scale in center proves lighter weight of plastic shell (actually only about one-half that of steel or brass cases). At left is assembled 105-mm. artillery shell whose plastic case has been test-fired six times at maximum gas pressure. (Photos, U. S. Navy)

Passing the ammunition should be an easier job for artillery men in the future, if further investigation confirms highly successful preliminary tests on injection molded, high-impact-type thermoplastic shell cases to replace strategic brass or steel.

These lightweight plastic cartridge cases, long the dream of military ammunition designers, are now being produced and tested by Navy scientists on an Army research contract. The work, conducted at the U. S. Naval Ordnance Laboratory, Silver Spring, Md., is being done with specially formulated ABS copolymer resins. Other materials tested for this application, both thermoplastic and thermosetting, failed to meet the stiff performance requirements imposed by the Laboratory. The plastic shell case must not only withstand firing under a wide range of conditions but must also be completely inert to the powder charge which it contains.

The new plastic case weighs less than half as much as the present brass or steel cases. Thus, for example, an artillery shell for the 105-mm. (4-in.+) howitzer weighs about 3 lb. less with the plastic case than with a brass or steel case. This weight difference, a logistic factor of great importance, besides making it easier and faster for troops to handle the ammunition, would save millions of pounds of shipping weight and cost. Even in peacetime, the military uses several million rounds of 105-mm. ammunition annually, mostly for troop training purposes.

Except for the steel base, which is an insert in the bottom of the plastic component, the entire cartridge case is molded of the ABS

material. The NOL prototype cases have been made for the 105-mm. shell, selected for preliminary tests because it is one of the most effective, versatile, and widely used weapons of the Army and Marine Corps ground forces. The plastic cases could also be made in various other sizes, depending upon the particular advantages over metal cases in each size. Some of the molded plastic cases have been successfully reloaded and fired as many as six times by the Naval Ordnance scientists without any reworking. NOL points out that this is not standard practice in actual troop operations, but helps to prove that the plastic cases are practical and operational.

In firing tests, the new thermoplastic cases withstood gas pressures ranging from 6000 to 35,000 p.s.i. and momentary flame temperatures exceeding 4000° F. at the instant of percussion. Despite these sudden and extreme temperature and pressure changes, the cartridge cases emerged from the gun breech essentially unscathed. The cases have also successfully passed NOL tests calling for extended conditioning at temperatures ranging from −65 to 160° F. immediately prior to firing in order to establish their dependability and uniformity.

May replace brass cases

At present, the single-cavity mold in which the plastic cases were made for the preliminary studies is being modified for limited production use. Tube Turns Plastics, Inc., Louisville, Ky., will shortly begin molding a pilot production lot of several hundred plastic cases, to be used for operational and cost studies by the Army. If these studies are favorable, the 105-mm. plastic cases may replace the traditional brass cartridge cases used for more than half a century, as well as the steel cases developed during the Korean conflict.

The wall section of the plastic shell case tapers from 0.040 in. at the open end to approximately ⅛ in. where it joins the metal base. Molded-in as an insert, the machined base has a series of circumferential inner grooves which anchor the metal and plastic parts together. Initial problems of differential expansion and shrinkage between the two materials have been overcome through design modification and special molding techniques.

The armed forces are vitally interested in the new plastic shell case for several important reasons. In addition to the weight factor, with its reduced shipping costs and easier, faster handling of shells by ground troops, mass production costs of the plastic case are expected to be competitive with metal cases. Exact costs cannot be computed at this time in the absence of mass-production contracts. However, the cost of materials for the plastic case, including the metal base, is expected to be about $1.40, and total cost may not exceed $2.50 per case, delivered. This compares with a reported delivered cost averaging about $3.40 for a drawn steel cartridge case of the same size.

Another important advantage cited by NOL is that production of the plastic cases would save huge quantities of brass and steel, both vital materials in wartime. Still another point is that the plastic cases can be run in almost any desired color, and a color code established for immediate identification of different types of artillery rounds. Such a system would have manufacturing, handling, and operational benefits.

In addition, the plastic case can be produced in quantity by conventional injection molding methods, thus permitting hundreds of U. S. plastics firms to perform the work and probably resulting in lower contract costs through a broadened supply base and increased competition.

Developmental work on the plastic cartridge cases at the Naval Ordnance Laboratory was largely performed in the Non-Metallic Materials Div. by Stanley P. Prosen and Walter T. Johnson under the direction of F. Robert Barnet, senior engineer.

Credits: Specially formulated Cycolac ABS resin from Marbon Chemical Div., Borg-Warner Corp., Gary, Ind.

Howitzer fitted with massive silencer is used at Naval Ordnance Laboratory to test-fire ABS copolymer shell cases



Melamine makes a mixer

Joint efforts of designer, engineer, and molder result in first one-piece housing for unique appliance

A new standard in plastics achievement has been set with the introduction of Waring Products Corp.'s latest piece of household mixing equipment—the Drink Mixer. For the first time in the history of small motorized appliances, a portable mixer is being offered with a one-piece molded melamine body incorporating integral mixing cavity, motor housing, pitcher handle, pouring spout, motor mounting bosses, and plug receptacle opening.

This is not just another entry in the crowded mixer field: it represents a major and significant advance in plastics design, engineering, and molding.

The successful production of the Mixer is significant for several reasons:

1) It presages new conquests for plastics in the small motorized appliance field. One-piece housings for electric drills, knife sharpeners,

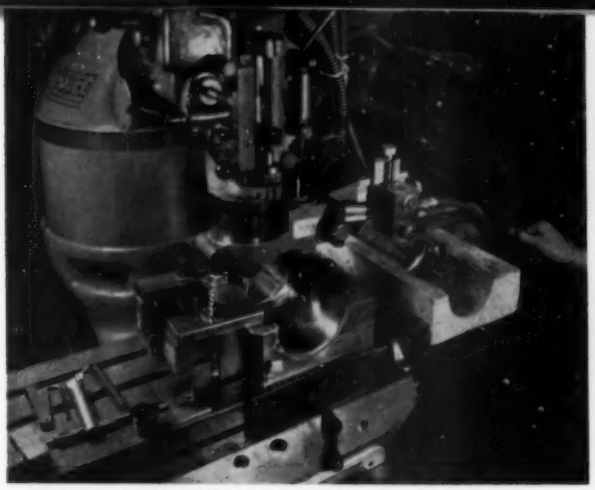


Finished Mixer, ready for sales room. Successful production of unit, made possible by new transfer molding technique, opens new markets for melamine. (Photo, Waring)

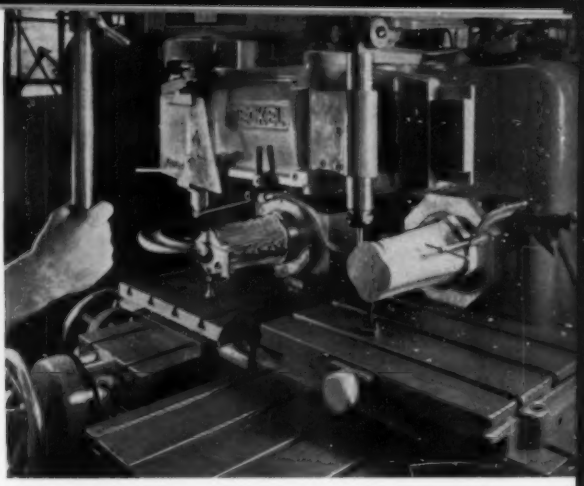
Molded body of Mixer (bottom) as it comes off transfer press. Triangular piece between body and handle is gate. Note pouring lip for dripless decanting. At top are two views of separately compression molded covers







Making the molds. Above is close-up of precision duplicating of one part of mold (left). At right in photo is master mold, made of a mixture of plaster and cement from original wooden model created by mold maker from designers' and engineers' drawings



Making the cores. Cement-plaster top core (right) guides rough cutting of steel core (left). After rough cut, core will be turned to eight different positions for precision grinding. Motor housing core is similarly produced. Operations shown were photographed in the plant of the mold maker, Liberty Tool & Machine Co., Irvington, N. J. (Photos, American Cyanamid Co.)

meat grinders, etc., are now just below the horizon. Large melamine pitchers can now be expected to adorn dinner tables in the near future.

2) It marks an important step forward in the art of transfer molding.

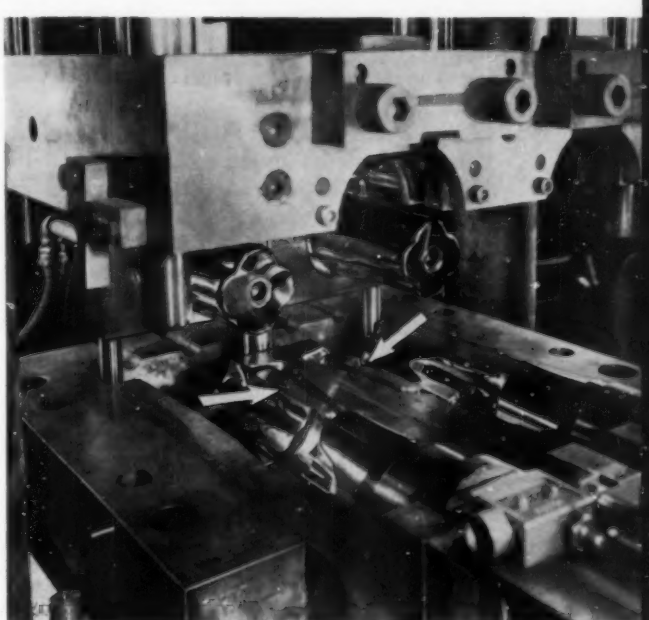
3) It establishes melamine (and by inference plastics in general) as a *superior-quality* material. It is another in the growing list of instances where plastics were chosen because they were *better*, not because they resulted in a less expensive product.

4) It provides an object lesson in team work. Imaginative design, top-notch engineering, versatile molding, and enlightened management worked *together* to accomplish the seemingly impossible.

Why melamine was chosen

Waring's decision to develop the new Mixer was rooted in the economics of the electric blender field. This field is one of keen competition. Many companies have entered it with units appreciably lower in price than Waring's famous line of Blendors. However, because Waring management insists on a top-of-the-line position, it could not meet this challenge by simply coming out with a cheaper blender. Instead, it was decided to develop a completely new unit, with its own particular functions, but within the price range of the cheaper blenders. This unit is the Drink Mixer. It is not a rival to the Blendor but its companion.

The Mixer was not to be just another kitchen appliance. In tune with living trends, it was to be at home and usable in any part of the house, whether kitchen or living room, patio or den.



Three-plate plunger transfer mold for mixer housing in open position. Top cavity cores are elevated and motor-housing cores are retracted. Triangular depressions (arrows) are gates. After motor-housing cores have been moved up by hand-triggered valve, and top-cavity cores lowered to meet at the contour line of the motor housing, the mold will be completely closed and heated to 285° F. Cores are heated to 310° F. In the meantime, melamine preforms have been fed into a loading well above the closed mold and preheated for about 55 to 60 seconds. The plunger is then activated to transfer the material from the loading well into the two cavities of the closed mold



After material has cured for about 90 sec. at 8000 p.s.i., the mold is opened part of the way and motor-housing cores are retracted. Then the bottom half of mold is lowered all the way and, simultaneously, the top-cavity cores are elevated. The molded parts remain on the top-cavity cores and are removed from there by hand. Cull and sprue, visible at top of photo, are then manually removed before start of next cycle.

Thus it had to be portable and modern in appearance. Portability, aside from light weight, implied that the unit had to be produced in one piece, incorporating both mixing section and motor housing.

What material would meet the requirements of low cost, portability, and styling?

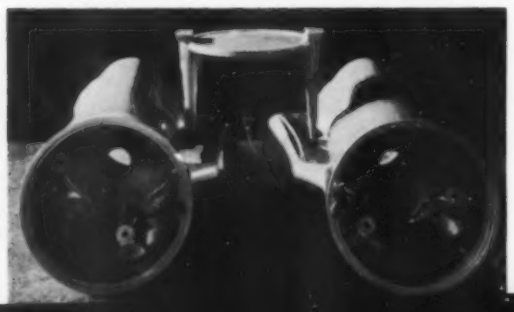
The choice fell on melamine. Melamine has all the physical properties required by the mixer—heat and break resistance, mechanical stability, etc.; in addition, it could be molded in integral colors that would never fade or chip off; marketing-wise, it would take advantage of the fact that the public had been preconditioned to accept the material as a natural adjunct at the dinner table; finally, it would permit the mixer to list at $24.95 retail, just a little more than half the price of regular Blendors, thus meeting the low-cost requirements.

Design and engineering features

The pitcher-like Mixer stands 12 in. high and has a mixing capacity of 24 ounces. It incorporates the clover-leaf pattern characteristic of Waring Blendor mixing vessels, which is important in producing efficient mixing action. A decorative rib running along the length of the front cleverly conceals the mold parting line. A lip molded into the top of the mixing cavity serves as a dripless spout.

The mixing cavity and the motor housing are both formed by cores. The motor-housing core is so designed that it also forms an opening for the plug receptacle as it meets the mold wall, avoiding the need for an additional core to provide that opening.

Two Mixer bodies, with cull and sprues, which are stripped apart as mold opens, assembled to show position in closed mold. (Photos, American Cyanamid Co.)



Molding the piece

The Mixer project was approached by the molder with the knowledge that success could be achieved only through the establishment of a molding flow pattern that would favor both the body section and the handle section. Ideally, this would involve the location of the gate between the handle and the body. Conventional mold design does not offer this opportunity.

The technique used is termed three-plate plunger transfer molding. In this method, the mold design uses a floating plate through which the material is routed to the various cavities. This permits the downward flow of material to the gate rather than laterally along the mold parting line. This arrangement also makes possible closer grouping of cavities as well as directness of flow through the runners from the loading well to the gate. Greater flexibility as to choice of gate location is permitted, including the opportunity to gate directly into the molded part, if desired.

Other common molding problems eased by this mold construction are:

1) Keeping runners and consequent flash away from inserts.

2) Routing runners to avoid interference with any side action.

3) Use of side actions in two or more directions per cavity on multiple-cavity molds.

4) Compactness of cavity layout.

5) Locating gate through the force into an area which will permit an unfinished gate stub.

The Mixer is transfer molded in a two-cavity mold. Total weight of shot is about 1200 g., which means that each Mixer consumes about 1¼ lb. of melamine. Details of the molding operation are given in the captions to the accompanying photographs.

Credits: Manufacturer—Waring Products Corp., New York, N. Y.; designers—Gerald Stahl Associates, New York, N. Y. and Astro Design Co., Bloomfield, N. J.; mold maker—Liberty Tool & Machine Co., Irvington, N. J.; molder—Shaw Insulator Co., Irvington, N. J.; material supplier—American Cyanamid Co., New York, N. Y.



Paint sprayer with lightweight molded nylon body puts less strain on user's arm than equipment using a metal body. (Photos, Chicago Molded Products Corp.)



One-piece nylon molding, incorporating molded-in threads (below), will not dent or break when dropped, is unaffected by greases, oils, or alkalies



Sprayer body: 66% lighter

One-piece nylon molding replaces assembly of three metal parts, brings other advantages

The importance of reduced weight, which plastics offer in so many applications, may not be readily apparent in a paint spray gun body. But the value is there: a new sprayer body molded of nylon in one piece is 66% lighter than the former metal model and therefore is much less fatiguing to the outstretched arm of the user.

The body of the new paint sprayer is injection molded of black nylon in a single-cavity mold. It replaces an assembly of three metal parts, eliminating six machining operations as well as polishing, plating, and assembling previously required. With the molded nylon part, the only finishing operation needed is removal of flash.

The weight of the nylon piece is 5 oz., compared to 15 oz. for the three-part metal assembly. Besides this weight-saving, the use of plastic brings several other advantages over metal: dried paint has less tendency to stick to nylon than to metal, making for a spray gun that cleans easier; the nylon will not bend or dent when dropped; the nylon-to-metal seal—where the gun is attached to the container that holds the paint—is a better guard against loss of air than the metal-to-metal seal formerly used. The black nylon used in the spray gun body is unaffected by oils, greases, or alkalies, has good weather resistance, and gives the molded part a shiny luster without painting or spraying.

With all its advantages, the nylon part costs less than the metal assembly it replaces.

Credits: Manufactured by Electric Sprayit Div. of Thomas Industries, Inc., Sheboygan, Wis. Molding by Chicago Molded Products Corp., Chicago, Ill., of Du Pont's Zytel nylon resin.

Operation dust-free

Reinforced plastics, acrylic, and other plastics components for aircraft are produced in new pressurized plant



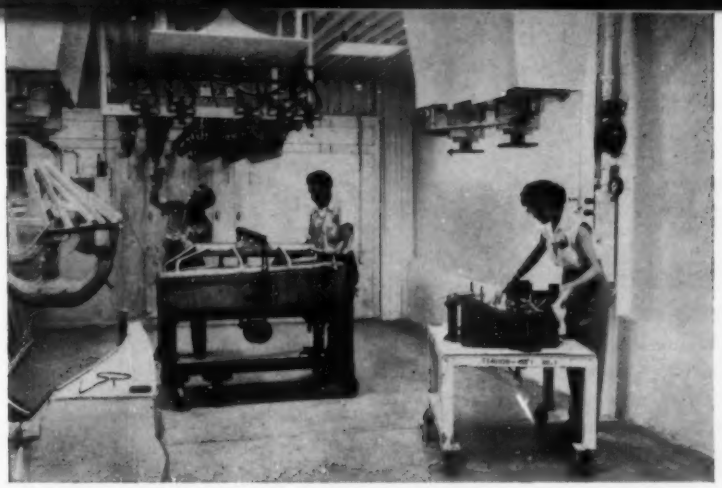
Crystal-clear acrylic canopy is buffed on production line. Quality requirements for these enclosures demand a plant atmosphere free of dust and similar contaminants

A completely pressurized building, dustproof throughout, has been constructed at Douglas Aircraft's Torrance, Calif., plant to house the company's plastics manufacturing operation. Extensive use of plastics in modern aircraft made it necessary for Douglas to install the new 75,000-sq. ft. facility. Along with all kinds of radomes, the plastics department produces a wide range of instrument panels, cockpit enclosures, ducts, dust covers, leading edges, and fin tips.

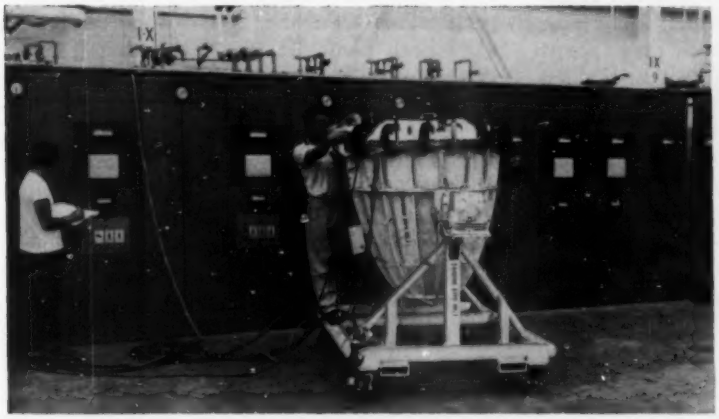
In the pressurized building, air is brought in through filters at roof top level and forced into the building by 11 compressor units. Complete pressurization of the building was necessary because 1) dust causes serious distortion in contact-formed parts in the molds; 2) metal dust reduces radar transmission of radomes, and 3) tiny specks of oil reduce the bond strength of plastics parts. Besides the filtering of all air that comes in from outside, dust and other air contaminants created in manufacture are controlled by vacuum-type dust collectors in the plant.

Douglas' new building was designed for three major production lines—reinforced plastics, acrylic products, and assorted plastics components for instrument panels—with a continual flow from one end of the building to the other. This arrangement has served to eliminate hand and conveyor handling of materials as much as possible.

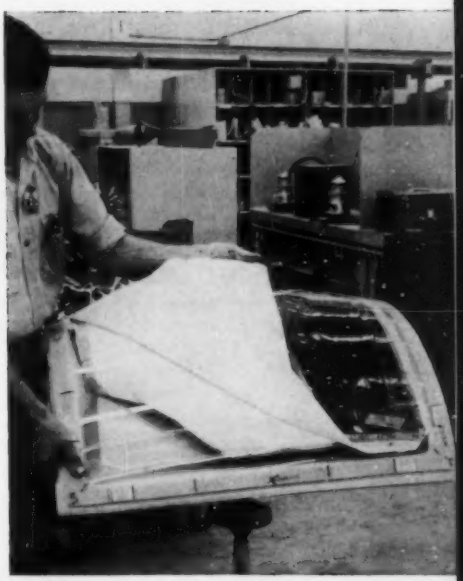
For special processes, the new building has two separately pressurized rooms within the pressurized plant. The larger of these rooms, 30 by 30 ft., is used for impregnation of fibrous glass with polyester or epoxy resins for reinforced plastic radomes and other parts. After lay-up, conventional curing of these parts is supplemented by various high production steam molds, each engineered for a specific plastic part. Another innovation consists of two autoclaves, 9 and 12 ft. in diameter, which are being used for curing plastic parts that require moderate pressures.



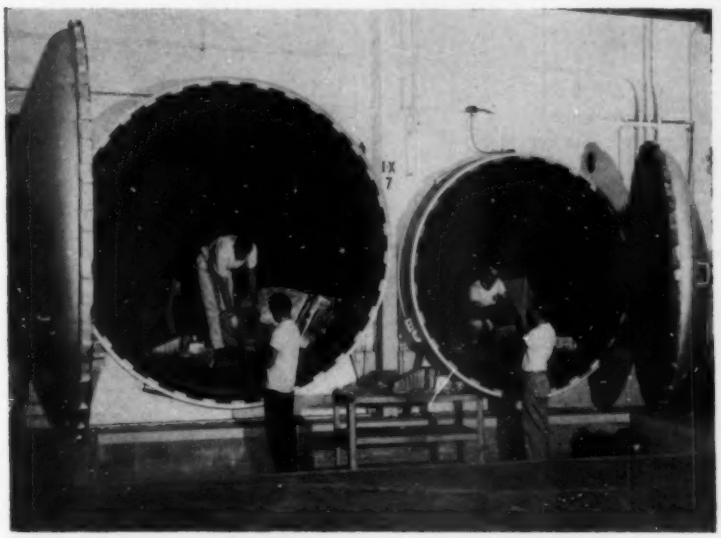
Dustproof room for forming plastics parts for aircraft is separately pressurized within main plant. Dust contamination would cause distortion and surface roughness which would lead to turbulence—especially undesirable in today's high-speed planes



Steam molds supplement conventional curing of reinforced plastics components. Parts progress automatically through predetermined cure cycles, triggered by thermocouples within mold. These are connected to steam control cabinets (in background)



Holding fixture, to which formed acrylic part is attached until installation on airplane, is a reusable device in Douglas' operation. Formed by drop hammer, fixture prevents warpage or distortion in transit. (Photos, Douglas Aircraft)



Autoclaves for above-atmospheric-pressure cure of parts

Automated extrusion

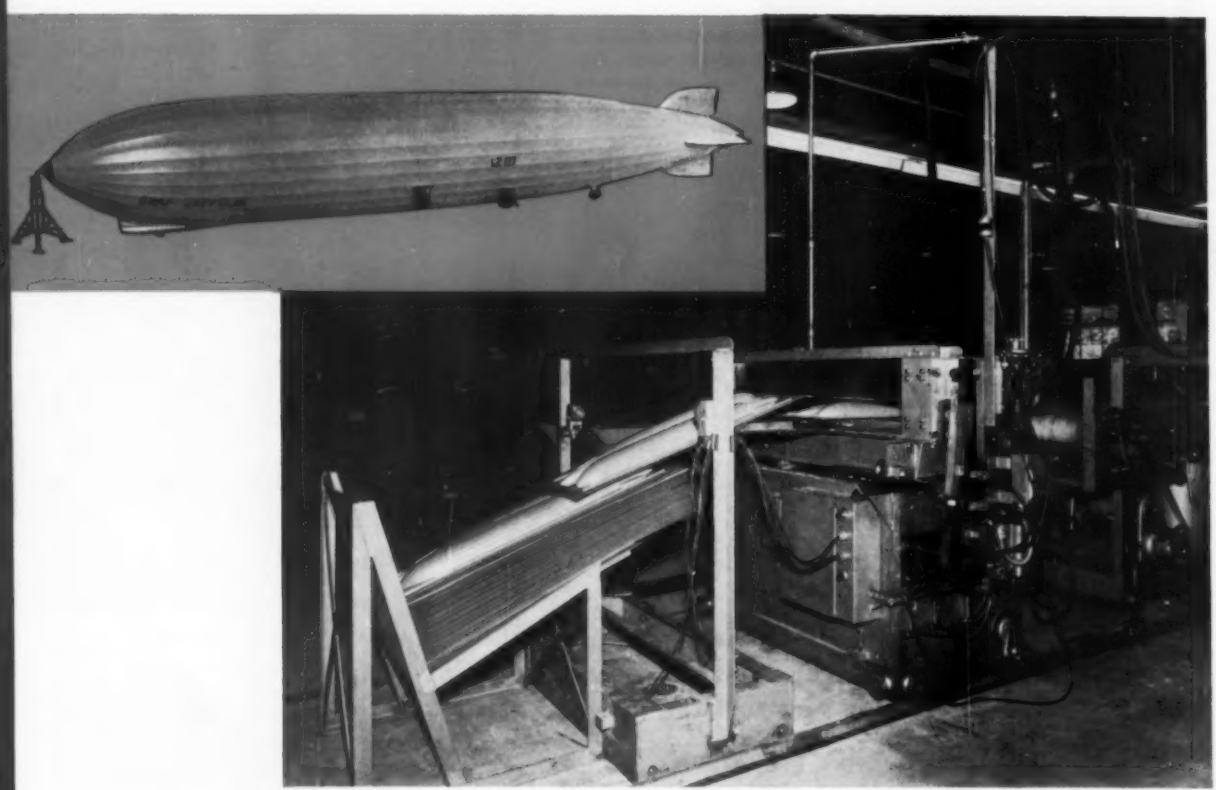
Continuous extrusion-thermoforming—one of the most highly automated production methods available to the plastics industry—is used to advantage in the manufacture of a 38½-in. scale model of the Graf Zeppelin, the famous 776-ft. German dirigible that made numerous trans-Atlantic crossings in the 1930's.

Merchandised in the form of a construction kit by Hawk Model Co., Chicago, Ill., the miniature Zeppelin is made up of two vacuum formed halves which, when assembled, comprise the complete shell of the airship. High-impact styrene sheet, in an authentic metallic aluminum color, is used for both these parts. Also included in the kit are injection molded styrene parts which make up the five motor gondolas, rudder and elevator control horns, tabs used in assembling the left and right shells with solvent cement, and a mooring mast and fin rest used in displaying the completed model. Twenty scale-sized interceptor planes are also supplied with the kit. To expedite handling during assembly, the injection molded parts are left attached to their sprues. All injection molded components are made by Hawk on its own equipment. Hawk also packages the entire kit.

Economics of forming

The continuously vacuum formed halves for the airship shell, authentically ribbed and having a 0.050 in.-wall section, are produced by Hamilton Plastics, Inc., Chicago, whose plant was specifically designed for this fabrication technique. Several examples of large-area parts other than the Zeppelin halves which have been made on this production line are illustrated on p. 106.

These typical products and components demonstrate the desirability of extrusion-vacuum forming in producing thermoplastic parts in which pronounced undercuts and differential wall sections are not required. In addition to the normal "plus" features of forming—lower tool cost, shorter tooling time, and lower piece cost (particularly on large-area parts and small



-thermoforming is used to produce large and intricate formed sheet pieces at high speeds

pieces made in large volume)—the hook-up between the extruder and the former provides added economies in substantially reducing handling operations and in speeding up production cycles.

Since no stress lines or welds are involved when forming a part, it is claimed that in many instances thin-wall thermoformed plastics pieces will show strengths equivalent to some injection molded parts with heavier wall thicknesses. Some of this increased strength is also believed to result from re-orientation of the heated plastic sheet stock during the forming operation.

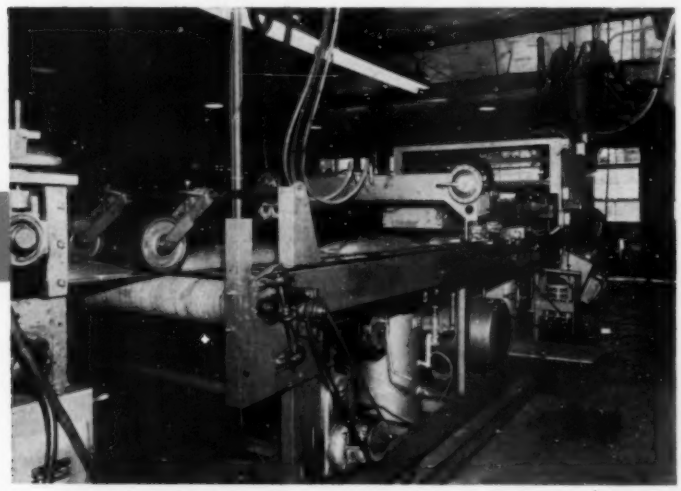
Production line

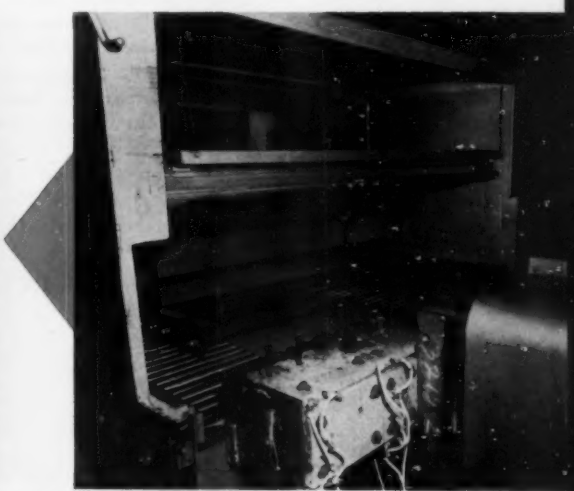
The production line as set up by Hamilton and shown in the accompanying photographs runs continuously from extrusion right up to the trimming of the formed pieces.

Feeding sheet material to the continuous vacuum forming line is a 4½-in. NRM extruder with a 50-hp. direct-coupled motor and a power unit which converts incoming 220 v. alternating current to direct current and provides efficient rheostat control of extruder operation. The five heating zones of the extruder barrel are independently regulated by a control panel, as are the five individually heated sections of the sheeting die.

Although the sheet which is extruded for this particular job is just under 20 in. wide, the installation is designed to extrude and form sheets up to a maximum width of approximately 40 inches.

The impact styrene extrusion material is first placed in a 500-lb.-capacity floor hopper, from which it is fed by air pressure via a pipeline to a 680-lb.-capacity hopper mounted above the extruder. Material at the bottom of the feed



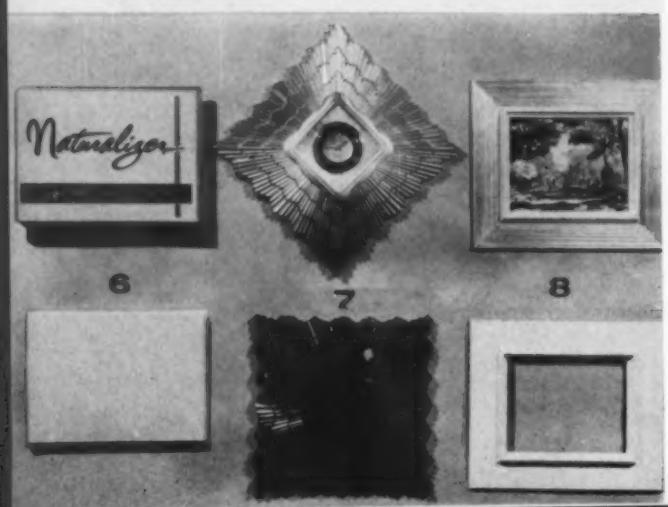


Model dirigible, 40 in. long and 5 in. in diameter (inset, left), is made up of two vacuum formed halves turned out at high speeds at the end of an automated continuous extrusion-thermoforming set-up (illustrated in photos above, running from right to left). At end of extruder (extreme right) is a five-zone die to produce sheeting about 20 in. wide. (Sheet up to 40 in. wide can be extruded and formed in this installation.) Roller-mounted die carriage which supports mold above extruded sheet is in retracted position. Electrical heating units are suspended above sheet. Water circulated through stainless steel take-away rollers reduces sheet temperature prior to forming. After forming, die lifts off extruded sheet (center photo), and moves back to begin next forming cycle. At end of takeoff assembly (left), formed sheet passes beneath shear (in center of photo) whose operation is controlled by electric-eye mechanism. Sheared sections drop into stack, ready for trimming operation



Other large formed parts

Among other typical parts produced on the automatic extrusion-vacuum forming installation described and illustrated in the accompanying article are an insulator pack (1) and drain pan (2) for automatic defrosting assembly. Both are made of impact styrene sheet stock for a major refrigerator manufacturer. Silverware tray (3) is vacuum formed from low-melt-index polyethylene sheet, giving it exceptional strength and resistance to detergents. Laundry and utility basket (4), made for Quaker Stretcher Co., Kenosha, Wis., is of impact styrene; it measures approximately 19 by 25 by 6¾ in. deep. Dual speaker housing (5) for J. P. Seeburg automatic phonograph serves as mounting for two 8-in. speakers, has depth of just under 7 inches. Indoor sign component (6) made for Price Bros., Inc., Chicago, is of medium-impact styrene incorporating an ultra-violet inhibitor. Various signs are silk screened directly onto exterior surface of this self-illuminated unit. Sunburst style frame (7) is used interchangeably with decorative mirror or electric clock by F. G. Ellerman & Co., Evanston, Ill. Center die insert is changed to accommodate both types of parts. Picture frame (8), 18½ by 21 in., also made for Ellerman, is run in white impact styrene, received gold antique finish around textured sides.



hopper is continuously dried and preheated by means of hot air which is forced into the hopper at this point.

A temperature of approximately 400° F. is maintained all the way across the die as the sheet is extruded. Emerging from the die, the sheet is carried on a series of powered stainless steel rollers, the first 58 of which are cooled by circulating water to reduce the temperature of the sheet and prevent sticking. The hood surrounding the first few feet of the take-off section carries a series of suspended Calrod units which may be used to step up the temperature of the extruded sheet before forming if necessary. On this application, only one such heater is used.

Continuous forming

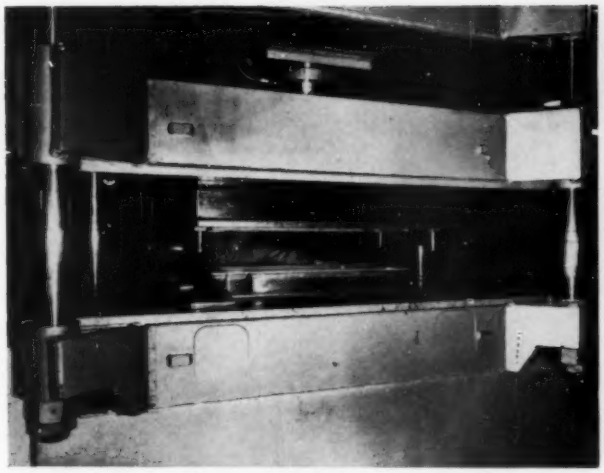
The mold which vacuum forms the Zeppelin halves as it travels with the moving plastic sheet is machined from a block of magnesium plate stock 5 in. thick and measuring approximately 39 by 15½ in. in size. There are six cavities in the mold—the two large Zeppelin shell cavities, which include the integrally formed rudder and fin sections, and four small cavities comprising the right and left stabilizer and elevator pieces.

The mold is designed so that the two large cavities are positioned parallel to the direction in which the sheet is extruded. Vacuum openings in the mold, made with a No. 82 drill, are so small (0.0135 in.) that they leave no mark on the finished parts. Approximately 15 water lines of ¼-in. diameter are drilled across the mold for circulation of water at 100° F. This serves to maintain the die temperature at between 120 and 140° F. during the thermoforming operation.

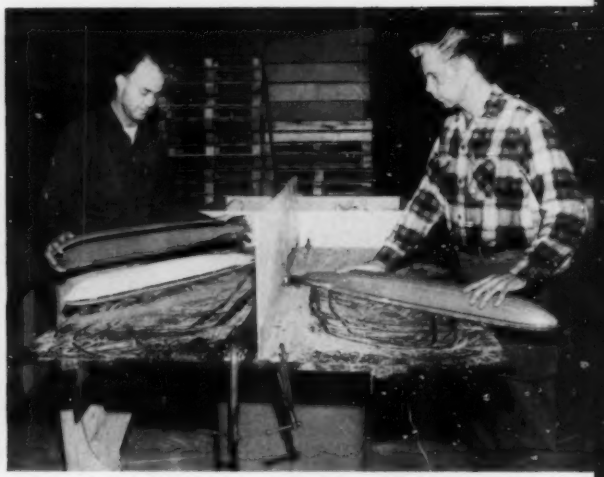
The mold is supported on a self-powered die carriage which straddles the extruded sheet and is free to move along two rails suspended above the take-off rollers. A series of Microswitch trips along the rail control the raising or lowering of the mold, the application of vacuum, as well as air pressure ejection of the formed part.

At the start of the forming cycle, the die carriage is in fully retracted position, only a short distance from the mouth of the die, and the mold is upraised. The die carriage then begins to move at the same speed as the extruded sheet and the mold drops into contact with the sheet.

Vacuum is now applied automatically and within one second the heated sheet has been



Operator places formed sheet in specially built 130-ton trimming press. Large parts are removed from trim die manually, small parts by air pressure



Formed slightly over required depth, dirigible halves are trimmed to exact dimensions at table equipped with rotary saw

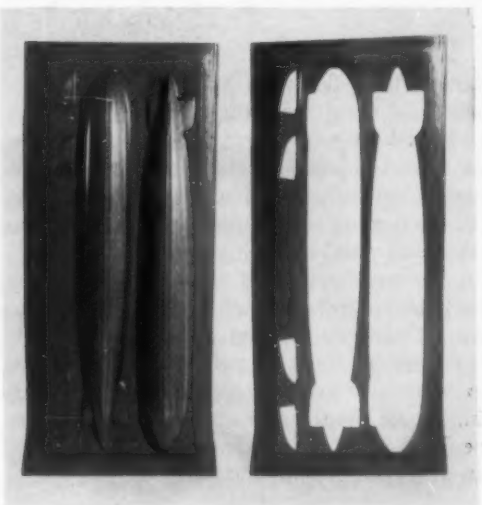
drawn into the cavities. At the end of the carriage travel, about 24 sec. later, the vacuum cuts off, air pressure is applied, and the die lifts off the sheet, ready to repeat the cycle. On this basis, approximately 150 complete sets of vacuum formed parts can be produced per operating hour.

Take-off and trim

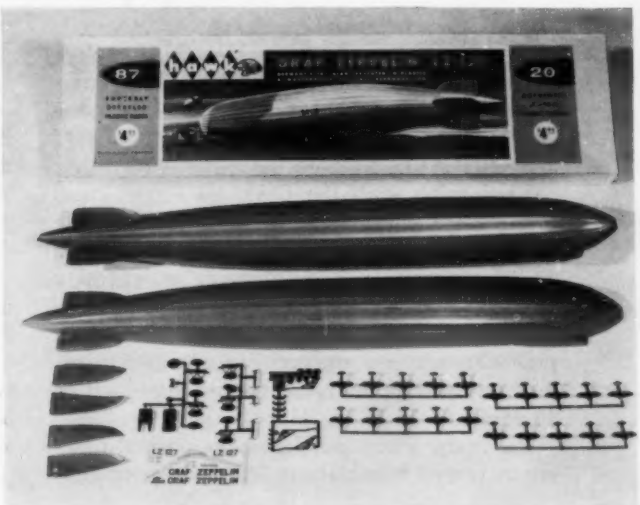
After passing over the tension rolls at the end of the take-off assembly, the formed sheet moves beneath an air-actuated shear which cuts the sheet between the formed areas into sections approximately 43½ in. long. Operation of the shear is triggered by an electric eye mechanism located beyond the shear, which depends upon interruption of the beam by the bulging profile of the airship sections. After shearing, the sections drop and stack automatically in a sloping rack, ready for trimming.

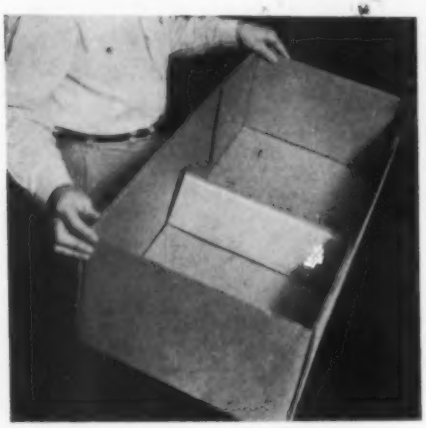
Trimming of the parts from the formed sheet stock marks the first manual operation performed on this production line. It is done in a specially built 130-ton press (To page 218)

Untrimmed and trimmed sheets indicate layout of cavities and efficient utilization of extruded sheet stock



Components of dirigible kit include formed Zeppelin halves and stabilizers; parts for gondolas, mast, etc., as well as interceptor plane models are injection molded





First step in new flower-packaging method is to place corrugated board insert at bottom of shipping box

No ice, no newspapers, no wooden boards are needed in new shipping system based on polyethylene film



Next, the box is lined with polyethylene film. The film is 6 ft. square; the excess hangs over the sides. (Photos, Colorado State University)

Savings in shipping

Colorful carnations from Colorado, shipped to all corners of the nation, can now travel lighter and arrive fresher, thanks to polyethylene film.

Economists with the Colorado Agricultural Experiment Station, in cooperation with the Colorado Flower Growers Association, have found a way to cut the shipping weight of a flower carton in half, and at the same time improve the keeping qualities of the blooms. In practice, this new method has resulted in reductions of shipping costs ranging to as high as 40 percent.

For many years shippers have packed flowers in waxed boxes about 3 ft. long, each containing 5 to 10 lb. of ice, many sheets of newspaper, and wooden boards to hold the flowers in place. The newspaper acted as insulation and absorbed water from the melting ice. Boxes frequently weighed 25 lb. and more, with the flowers accounting for only a fraction of the total weight.

In the new method of shipping, all the ice, newspapers, and wooden boards are eliminated. Only two packing materials are used: a 6-ft. square sheet of polyethylene film and two inserts of corrugated board, each about 5 in. longer than the box and scored to form a peak when placed inside.

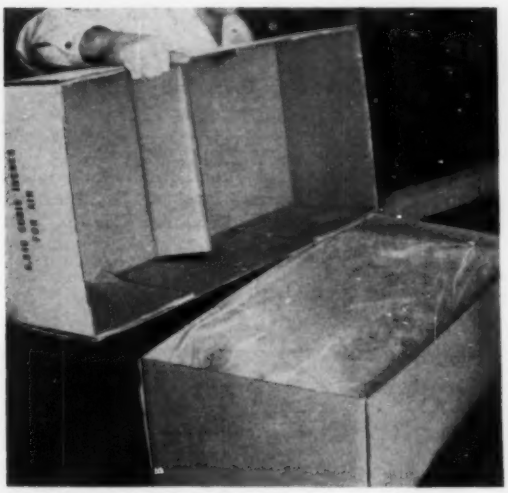
In preparing a shipment, one insert is placed



Lined box is now filled with carnations. Blooms are placed at alternate ends and stems rest on peak of corrugated board insert at bottom of container



Excess polyethylene film liner is then folded over packaged flowers and tucked in, assuring moisture retention during shipment



Telescoping lid, with same insert as in bottom of box, is placed over carton. Inserts hold flowers securely in place during transit

carnations

in the bottom of the box and the second in the lid. The square of polyethylene film is then inserted as a liner, with the excess hanging over the sides. When the flowers are in place, the film is folded over and tucked in to make what is practically an air-tight seal.

In filling the box with carnations, the packer places the blooms at alternate ends, permitting the stems to rest on the bottom peak. When the lid is in place, the two peaks leave a space of about 2 in.—just enough to hold the stems in place without crushing them.

Principal advantages of the new pack are:

1) It permits packing of flowers in a horizontal position so the stems lie straight. There is no pressure on the stems and a sudden jar will not break them.

2) The high humidity maintained by the polyethylene wrapping tends to prevent petal-edge burn of the bloom.

3) The polyethylene film envelops the flowers and tends to dampen vibration in transit. It holds them securely in position, thus reducing breakage.

4) The new system uses a minimum of packaging material and permits more flowers to be packed in a box of given size.

Several Denver wholesalers have adopted the new flower-packing method for all or part of their carnation shipments.

License plate frame

Safety-minded motorists can now install license plate frames that not only add beauty to the car but at the same time provide night-time protection to the vehicle. Designated Reflect-A-Frame, the device consists of a polyethylene frame into which have been molded acrylic beads (28 beads per frame). Reflections of light striking the beads are visible at distances of over 350 yd., minimizing chances of accidents in case of tail-light failure.

A complete unit is injection molded in one piece at a rate of 1000 units per day per injection machine. A special technique is used to mold both frame and beads and "embed" the beads in the frame all during one cycle. Lugs molded into the base of each bead prevent it from coming loose in the frame. Retail price is $1.98 per pair.

Credits: Molded and marketed by Excello Devices, Inc., 200 Fifth Ave., New York, N.Y.; Tenite polyethylene by Eastman Chemical Products, Inc.; Lucite acrylic by E. I. du Pont de Nemours & Co., Inc.



PLASTICS



Polyethylene wrap

Another handy plastic film wrap for the household market has made its appearance—thin transparent polyethylene. Easily torn to size on a serrated box edge, Poly Wrap-It is manufactured in roll form for use in refrigerator and freezer wrapping, and for protecting sandwiches, snacks, and salads. The material is strong, soft, and flexible even at freezing temperatures. The polyethylene, highly resistant to moisture, serves to retain natural food flavors when used as a food wrapper.

The thin film is supplied in a roll 11½ in. wide and 25 ft. long. It is excellent for wrapping food dishes of irregular shape, since the tasteless, odorless film drapes freely without stiffness. Baked goods wrapped in the new household film stay moist even after the wrapping has been opened several times.

Credits: Manufactured by Polyesters Div. of Cello-Masters, Inc., New York, N.Y., of Bakelite polyethylene.

RP toboggan

Both snowtime fun and safety are offered small fry by a new bright red reinforced plastics toboggan. The toboggan is safe in two ways: because of its smooth-surfaced plastics construction, a youngster cannot pick up splinters or hurt himself on sharp edges; also, he can touch the cold surfaces without fear of pain or injury.

The new toboggan is four feet long—just the right size for one stretched-out youngster, or two riding one behind the other. The toboggan, light in weight and slick-surfaced, will slide swiftly over even the smallest amount of snow as it skims over the top making its own track as it goes along. Molded of polyester resin reinforced with fibrous glass, the simple, one-piece construction of the new toboggan makes for a sturdy, hard-to-damage vehicle for winter fun.

Credits: Manufactured by Plastics Products Co., 24001 Aurora St., Cleveland 22, Ohio, using Owens-Corning Fiberglas.



PRODUCTS



Baby bath

Infants can be bathed in the height of comfort with E-Z Bath, a portable thermoformed tub with a sponge-padded molded incline that supports baby's head above the water and frees mother's hands for the bathing ritual.

The bath is vacuum formed of 5/32-in. high-impact styrene sheet. The incline, an integral part of the unit, is covered with a urethane foam pad which lies in a recessed area. The incline runs almost the entire length of the tub, rising from the bottom at a comfortable angle. Since the water stays in a "moat" surrounding the incline on the bottom and two sides, the child is always safely above it. Weighing less than three pounds, the bath measures 30 by 19 by 6 in., and is made in white, pink, and blue with contrasting color pads.

Credits: Manufactured by Toidey Co., 5908 S. Fairfield Ave., Ft. Wayne, Ind. Vacuum-forming by Fabri-Form Co., 116 Seneca St., Byesville, Ohio. Styrene supplied by Catalin Corp. of America.



Radiant-heat screen

Ingenious use is made of two plastics materials in a newly developed radiant-heat screen. This portable electric heater, in the form of a three-panel dressing room screen, works by warming a person directly instead of the air around him. The operating parts of the heat screen are an aluminum-foil heating circuit, laminated to 2-mil polyester film. The screen is faced with 14-mil vinyl sheeting. The polyester film is rated at 4000 v./mil and has a melting point above 450° F. The vinyl facing, when heated to about 70° above ambient room temperature by the electrical circuit, radiates infra-red rays out of the front of the screen. These rays create comfortable warmth but the screen itself never becomes hot to the touch and will not scorch anything with which it comes into contact. The heater can be plugged in any household outlet.

Credits: Manufactured by Arvin Industries, Inc., Noblitt St., Columbus, Ind., using Du Pont's Mylar polyester film.

PLASTICS



Blind cleaner

A special vacuum cleaner attachment, designed to make dusting venetian blinds easier and faster, eliminates the need for using soap and water or dusty rags. Called V-Vac, the device slips easily over the hoses of most cleaners without an adaptor. In use, a double set of dusters runs over and under each slat of the venetian blind at the same time, cutting work in half.

The new attachment is injection molded of butyrate in two-cavity molds, and the dusters are formed of soft, deep pile fabric of Dynel acrylic fiber. These dusters, which do not scratch paint but have enough body to do a thorough cleaning job, can be removed quickly for cleaning. They can be washed without matting or becoming stiff, according to the manufacturer.

Credits: Made by W. & W. Mfg. Co., 707 Main St., Grandview, Mo. Molding by Kuhlman Plastics Co., 3734 Gardner Ave., Kansas City, Mo. Butyrate by Eastman Chemical Co.

Ceiling tile



Extreme ease of application marks new, lightweight ceiling tile panels vacuum formed of thin gage plastics sheeting. The panels can be put up with adhesive, staples, or nails. No furring strips or ceiling preparation are necessary.

Trim-Quik ceiling tile is manufactured in 20- by 30-in. panels, each panel consisting of 6 tiles. The product is available in 12-mil vinyl and 14-mil styrene, and it is produced on an automatic roll-fed vacuum former with a 36- by 24-in. bed.

In addition to ease of application and low cost, the plastics panels are washable and will not warp, stain, discolor, or conduct electricity. They are verminproof, and can be painted before application, if desired. Three patterns are available—quilted (illustrated), sea foam, and shell. Colors are white and gold-and-white antique.

Credits: Manufactured by Hallmark Plastics Corp., 151 Division St., S. Hackensack, N.J., from Firestone vinyl (Velon) and Dow styrene (Styron).

PRODUCTS

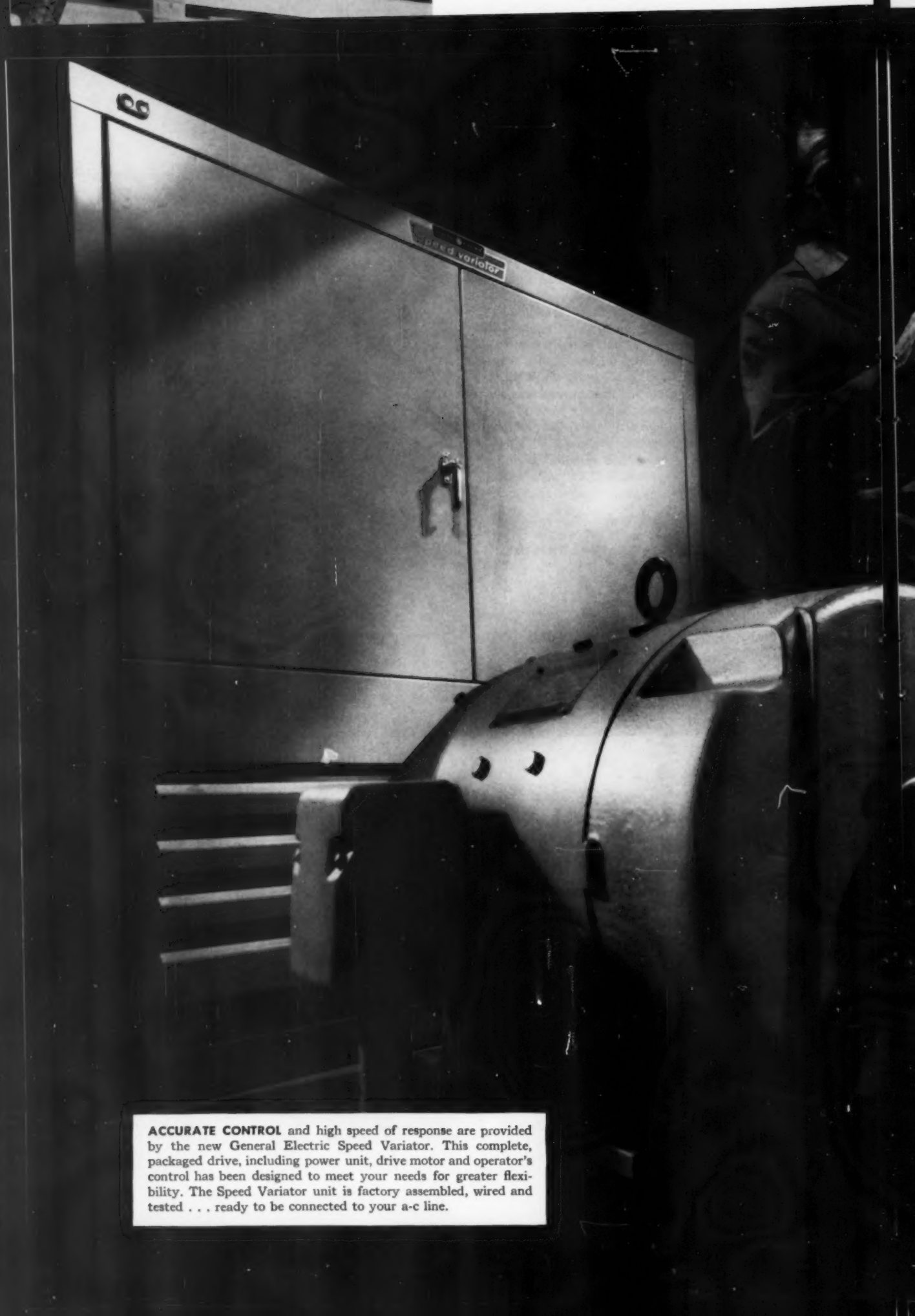
Copolymer scrub brush





A new all-plastic household scrub brush is said to outlast conventional scrub brushes five to one, as well as to be better in several ways. The block of the new brush, molded of styrene-acrylonitrile copolymer, is resistant to swelling and warping so that bristles remain firmly set to provide an even scrubbing surface. The copolymer also withstands the action of strong soaps and detergents. The block, molded in one piece, has a molded-in hole for hanging, molded-in corrugations for sure grip, and sturdily set bristles that resist shedding. The stiff bristles are made of styrene monofilament and resist the matting that shortens the life of natural bristles. They stay stiff even when continuously soaked in hard water, and make cleaning faster and easier.

Credits: Produced by Empire Brushes, Inc., Port Chester, N.Y., of molded styrene-acrylonitrile copolymer (C-11) and styrene monofilament from the Bakelite Co.



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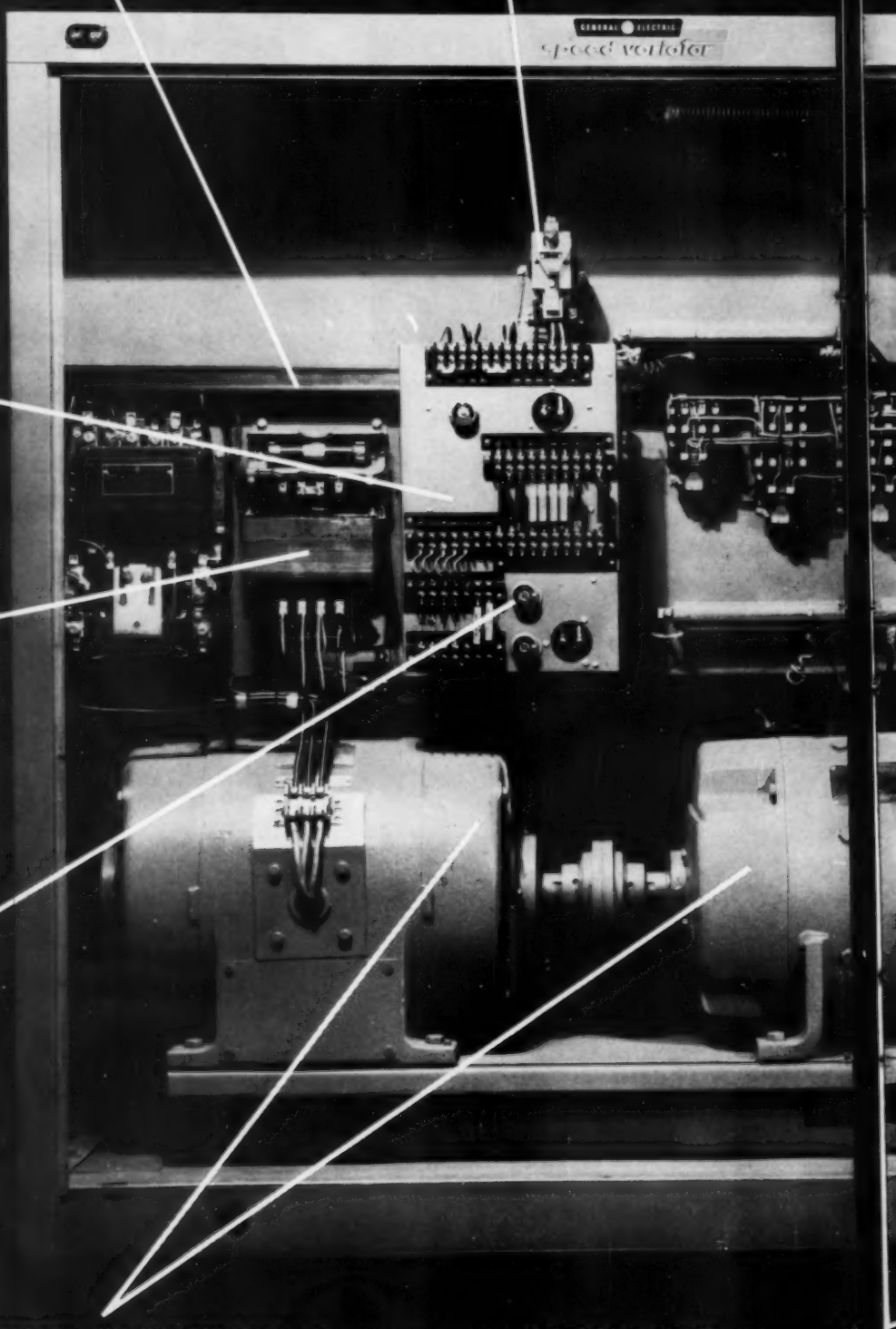
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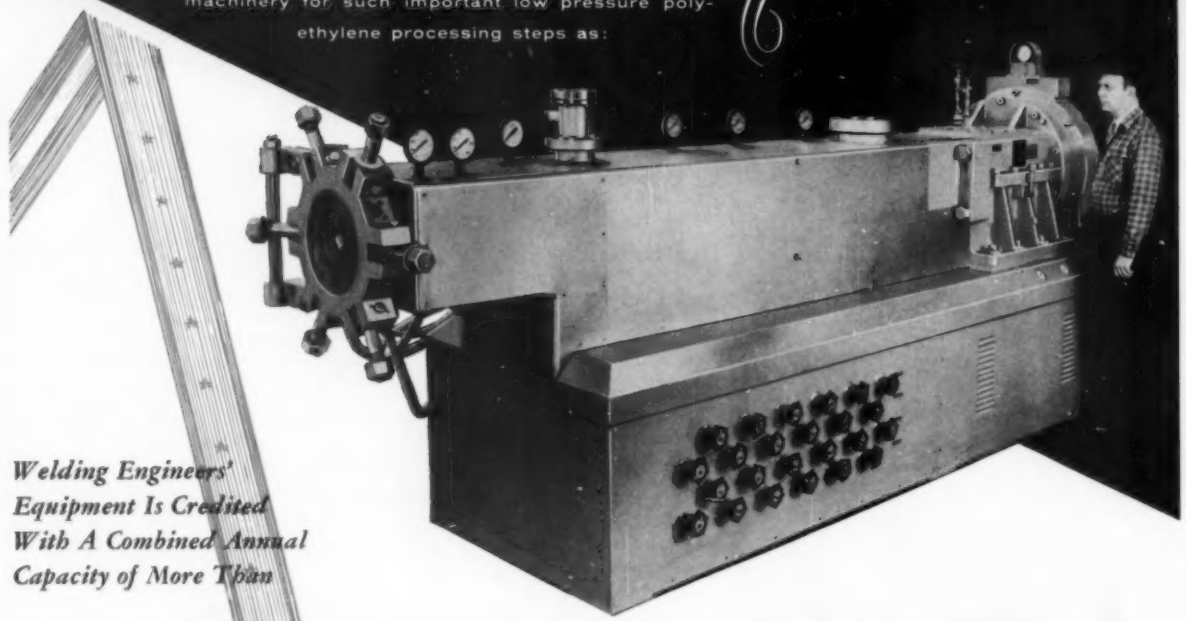
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Dr. James F. Carley, Engineering Editor

Reinforced plastics by "sprayup"

The sprayup method centers around a triple gun that ejects streams of resin and glass which meet at a focus outside the gun. The mixture, very uniform in composition, adheres to any surface it strikes. Because mixing is external, very fast-setting resins can be used. Wetting-out is excellent, finished moldings contain less than 1% voids, and mechanical properties are superior to those of moldings made from hand laid up mat. Sprayup offers impressive cost savings both in labor and material. The process is feasible for making all but very small or very intricate moldings.

The "sprayup" method, which applies mixed resin, catalyst, promoter, and chopped glass roving to the mold or form, seriously challenges hand layup of mat: sprayup yields reinforced moldings of equal or better quality with about one-fourth the labor and with greater convenience. Per-part cost of finished moldings, even when only short runs are involved, is about on a par with the cost of parts made by matched-metal molding techniques in long runs.

Glass-reinforced moldings have previously been made by one of three processes: 1) compression, transfer, or injection molding of premixed resin and glass fibers. 2) Hand layup of glass mat or woven cloth, followed by impregnation of the cloth with thermosetting resin and curing of the impregnated mass. Curing may be done without pressure (contact molding), with atmospheric pressure (vacuum bag molding), or with positive pressure (pressure bag and matched metal molding). 3) Preforming of chopped rovings into a shaped mat-like shell followed by any of the three molding processes used in hand layup. Preforming may be done by blowing the fibers, together with a little binder resin, onto a form or mold with air, or by depositing them onto a shaped screen from a water slurry. Resin impregnation may be accomplished by simple pouring and spreading methods or by spraying. Curing is usually done by matched-metal molding, because the preforming method has been found most economical for large-volume production of medium-sized pieces.

The sprayup method is a logical extension of the preforming technique and sprayed-up wet laminates may be cured by any of the three techniques used for layups. In general, however, matched metal molds will offer no advantage with this process, except perhaps in those instances where very close tolerances are required.

News has been received of three independent developments of sprayup equipment, two that coat the mold with a mixture of resin and chopped roving, and a third that lays on unchopped roving and resin. The simpler of the two processes for sprayup of chopped roving and resin was developed in its present form by the Rand Development Corp. of Cleveland, Ohio, and patents have been issued in U.S. and Canada. The second process is somewhat more versatile, though more complex and cumbersome; it belongs to Aust & Schüttler of Düsseldorf, Germany. The unchopped roving process was brought out by the Sealzit Co. of Riverside, Calif. This article deals only with the chopped-roving processes.

Rand process

The heart of this process is the gun, which resembles a pair of bicycle handlebars to which are attached two resin-spraying nozzles and, in between, the device that chops the roving and hurls it out. The resin guns are fed from simple pressurized tanks or by pumps. From one to five strands of roving can be fed into the cutter, which ejects them out in uniform lengths that may be regulated from ⅜ to 4 inches. The hurling action of the cutter also randomizes the strands so well

*Reg. U.S. Pat. Off.



Fig. 1: Operator tests roving cutter of sprayup gun, which is powered by adapted ¼-in. drill. (Color plates, Rand Development Corp.)



Fig. 2: Sprayup man begins first pass on small dinghy hull. Mold has been tinted blue, resin yellow to make it easier to follow work

that there does not appear to be any dominant orientation of strands in the laminate.

The two resin sprayers, on either side, are mounted on ball joints so that they can be focused to meet the flying glass strands in any local region between the gun and the target. Thus the final mixing of the resin is accomplished outside the gun, permitting the molder to use resins that have very short pot lives after mixing, but which can be held for a couple of days in the tanks. Regulating valves with numbered dials serve to control the rates of resin delivery from the spray nozzles.

In practice, the gun operator sprays about enough glass-resin mix to give a finished layer 1/16 in. thick or less. This is rolled out lightly with a rubber roller, corners being smoothed with a pass of a small paint brush. A typical small boat hull would require three spraying passes and roll-outs. Figures 1, 2, and 3, below, show two men cooperating in this procedure. Actually, one gunner can keep several roll-out men busy.

Glass is broken, not cut

Reinforced fabricators know how fast tools wear in working glass-reinforced moldings. The great hardness of the glass fibers is responsible for this fast dulling of edged tools, and for a long time it held up the development of the sprayup gun. Even tungsten carbide edges dulled so quickly that frequent honing and changing of blades were necessary, seriously reducing the productivity and convenience of the gun. When this problem was brought to the attention of Rand's head physicist, he pointed out that glass, being hard and brittle, shouldn't be cut; it should be broken. A new "cutter" was devised that does just this (see Fig. 5, p. 121). It consists of two tangent cylinders—one metal, one covered with silicone rubber—rotating in opposite directions. Ordinary, injector-type, single-edge razor blades are clamped into the metal cylinder (Fig. 6, p. 121). As the roving passes between the two rollers, the razor blade presses it into the soft rubber, causing the strands to be bent so acutely that they break. Since the acuteness of bending is not seriously reduced by some dulling of the blade, one set of blades will break hundreds of pounds of roving. And it takes only a few minutes to change the inexpensive blades. The cutter is capable of delivering up to 3 lb./min. of chopped roving, and the gun has consistently wet-out up to 5 lb./min. of 30%-glass laminate. To make a comparison: the gun's glass output is about equal to that of one preforming machine (at about 1/8 the investment); it also eliminates the handling and baking that go with the preforming method.



Fig. 3: Gunner moves to new surface while coworker rolls out area already sprayed. Average small boat hull requires three passes and roll-outs



Fig. 4: Rough edges along gunwale are trimmed with small power saw. Trimming completes manufacture of hull, which is then lifted out of the mold

Laminate properties are good

One of the startling features of the sprayup process is the excellent physicals that can be obtained, even with soft-chrome spun roving. An important reason for this is the thoroughness with which the glass fibers are wet out by the resin as they are sprayed up. There are no large bubbles of trapped air, as in hand layups, and the finished laminates contain less than 1% voids. Thick sections are often transparent enough to see through. The resin is not weakened by undesirable binders, as may be the case in preform molding. Higher glass contents than are practical with hand layup can be easily achieved by sprayup; this also makes for better physicals. Flexural strengths of 30,000 to 40,000 p.s.i. have been obtained with polyester laminates containing from 30 to 40% glass, the continuous-fiber, hard-chrome rovings being cut to 1.1-in. lengths. Corresponding flex moduli were about 1.6 to 1.8 $\times$ 10^6 p.s.i. Laminates made from soft-chrome spun roving cut to ¾ in. lengths and having 38% glass had flex strengths of about 30,000 and moduli of about 1.2 $\times$ 10^6 p.s.i. Tensile strengths are lower than might be expected from these flexurals, running around 14,000

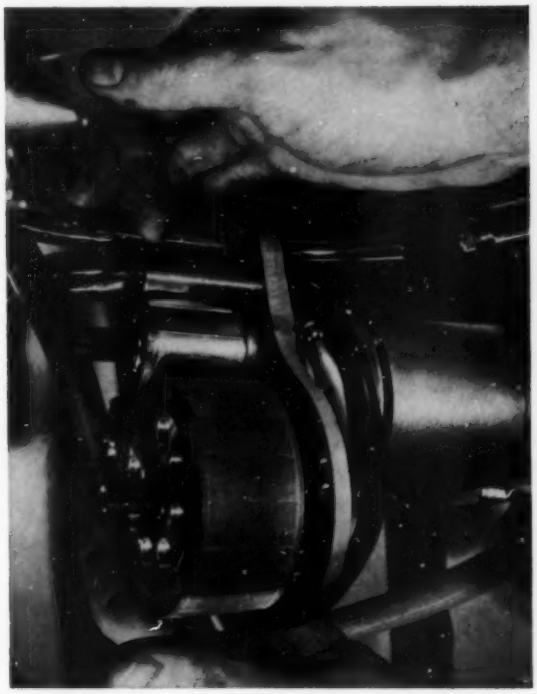


Fig. 5: Close-up of "cutter" in Rand gun. Rovings pass between two rollers where they are broken by razor blade that bends them sharply by pressing them into soft rubber roller (at bottom in photo)



Fig. 6: Slipping a new blade into blade-holding roller of sprayup gun. Number of blades used determines the length of broken-off strands. (Photos, Rand Development Corp.)

p.s.i. for hard-chrome continuous rovings and 12,600 p.s.i. for soft-chrome spun rovings.

These figures don't tell the whole strength story, which, in any commercial structure, depends on more than the strength of straight pieces under unidirectional stress. Stiffness—usually more important than strength in reinforced-plastic structures—can be improved by ribbing and beefing up loaded areas at critical points. This beefing-up is easy with the sprayup process. Ribs can be made by laying hollow paper tubes along the mold and spraying over them. Corners and joints are usually weak points in laminates laid up from mat unless great pains are taken in forming them. Sprayup eliminates joints, and corners can be thickened with ease.

A factor in the strength of products made by hand layup has been the great range of glass content from point to point in the finished laminate. This has been due partly to lack of uniformity in the glass mats themselves and partly to poor distribution of resin and glass during layup. Tests of laminates sprayed-up with the Rand gun indicate that the maximum point-to-point variation in glass content is about one percent.

What can be made?

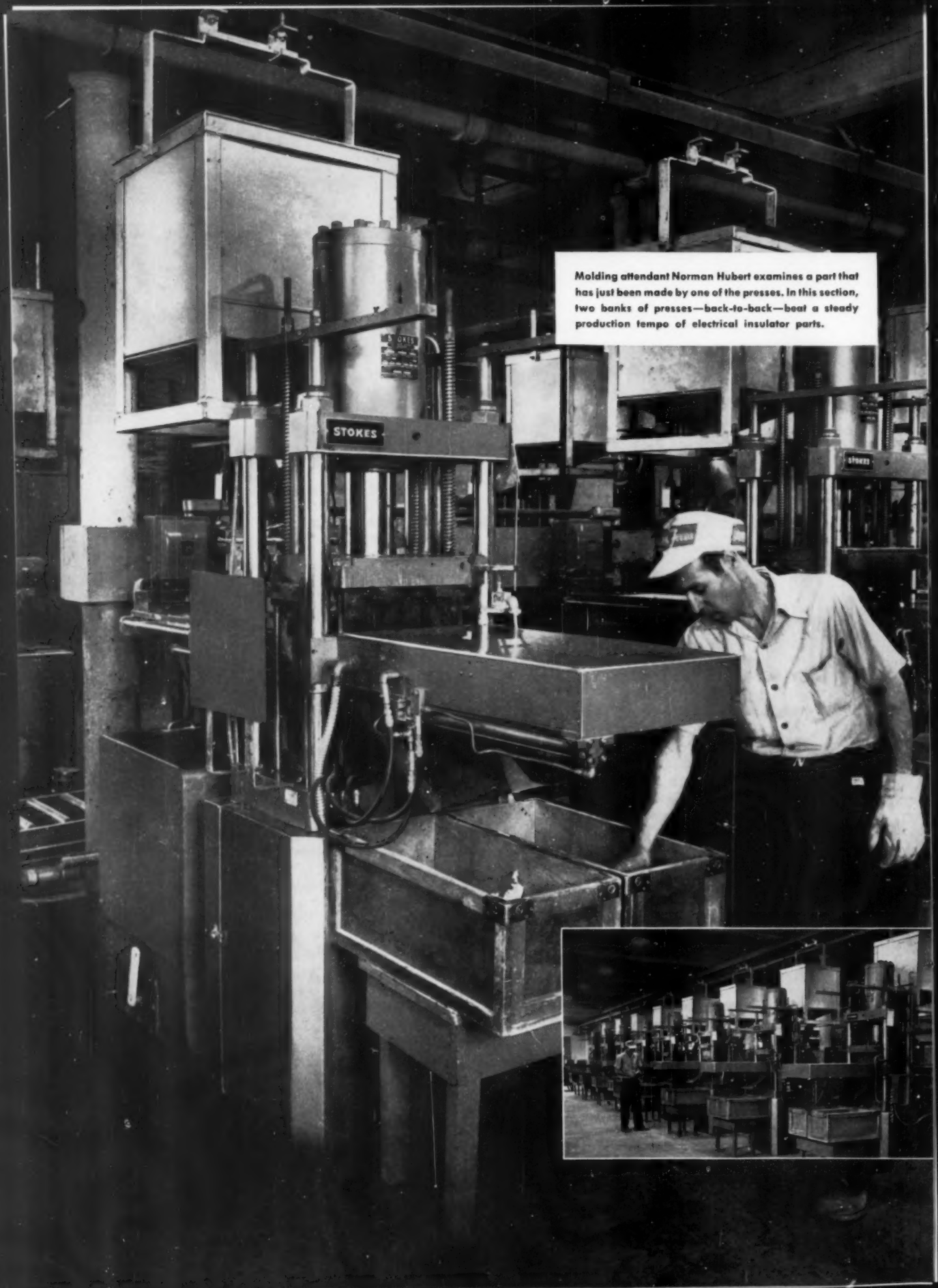
Except for very small pieces and those having deep indentations difficult for the gun to "see," almost any piece that can now be made of reinforced plastics can be made by the sprayup process. Since the parts are as strong as bag-molded hand layups of mat and stronger than those made by contact molded mat, all products now made from mat are fair game for the sprayup processes. And since sprayup offers startling economies (discussed below) over layup, there is a good chance that the new method will soon make mat molding obsolete.

Pieces as small as a flat 10- by 6-in. mortar trowel seem feasible. A cover for a rotary type lawn mower is being considered for manufacture by sprayup. But a 20- by 12- by 12-in. motor housing with indentations was difficult to make with uniform strength and thickness control. Since the focus of the glass and resin streams is not a point but a volume in space with a cross section of several square inches, it is difficult to throw good mixes onto areas smaller than this cross section, particularly near corners. (Rounded corners, by the way, favor the sprayup process).

Boats and buildings

At the other end of the size scale there seem to be no limitations to the sprayup process. The two biggest uses of reinforced plastics are boats and corrugated sheet. Automated sprayup looks very promising for sheet, while the present gun has boat makers racing their motors. At present, the Larson Boat Works, Little Falls, Minn., is the only boat maker with a sprayup-engineered production line, but the process will probably invade the boat field fast. With proper formula-

(*To page* 124)



Molding attendant Norman Hubert examines a part that has just been made by one of the presses. In this section, two banks of presses—back-to-back—beat a steady production tempo of electrical insulator parts.

Bryant Electric's Plastics Department buys additional Stokes Model 741's for high-speed automatic molding

Fully automatic compression molding, on Stokes Model 741 presses, produces a wide variety of insulating parts for appliances, wiring devices and switch gear for this Connecticut manufacturer.

The Bryant Electric Company, Plastics Department, a subsidiary of Westinghouse Electric Corp., is thoroughly convinced of the excellence of Stokes automatic molding equipment. Twenty Model 741 50-ton presses have been in constant use, with another six just installed. Molded insulating parts for electrical appliances, lighting fixtures, switch gear, wiring devices, and the like, are being produced at high rates of speed—with dependable precision.

The fully automatic operation of the 741's requires minimum monitoring—there is not much that the attendant does other than remove the bins when they are full, occasionally check on parts as they are dumped into the bins, and load the hoppers with the molding compound.

The Plastics Department of Bryant selected Stokes equipment for its high standards of workmanship and excellence of service. Fully automatic production of these parts resulted in lower manufacturing costs and enabled them to meet competition more favorably.

For your own molding operations, it will pay you to check the advanced features of the new Stokes 741's that bring you fully automatic compression molding in its most fool-proof, most productive form.

25 years of leadership in automatic molding is built into these presses:

Parts can't fall back into molds . . . due to metal-to-metal contact between feed and comb, and scrape-off discharge independent of gravity.

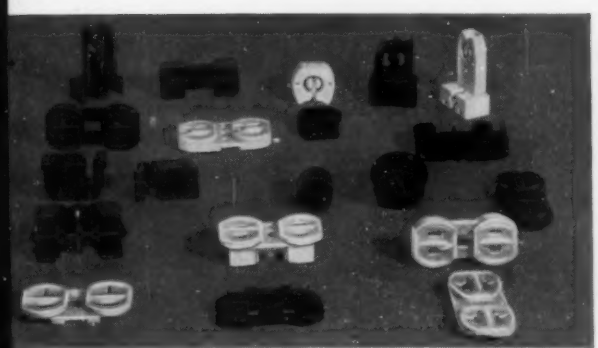
Simplified set-up . . . feed changeovers made in five minutes. Pre-set loading board provides custom-adjusted feed for each job as part of the tooling.

Fast cycle, high output . . . average dry cycle time only 8 seconds.

Space-saving . . . in-line press design cuts floor area requirements, lets you line up feed and discharge in convenient rows.

Tops in versatility . . . positive top or bottom ejection available to suit the job . . . side-draw split cavity molds . . . automatic pre-heated powder feed . . . automatic feed of rope pre-mix.

Press capacities of 50, 75, 125, and 200 tons are available. Write today for a copy of our new bulletin on the Model 741, for a consultation on your requirements, and for a cost study on your specific applications.



Above are some of the many parts produced at the Plastics Department of Bryant Electric including duplex outlets, switch blocks, and fluorescent lamp holders. At left, a partial view of the bank of Stokes 741 presses installed at Bryant Electric's Plastics Department.

Plastics Equipment Division
F. J. STOKES CORPORATION
5500 Tabor Road, Philadelphia 20, Pa.

STOKES

tion of the resins, vertical and overhanging surfaces (e.g., ceilings) can be covered with reinforced plastics. The method may lead to large-scale use in building construction.

Swimming pools look like a "natural" for sprayup, with its jointless construction. A thin vinyl envelope laid into the excavation would keep the resin from being drained from the glass fibers by the soil, while the excavation itself would provide the needed mold rigidity.

Another promising new field is that of military and industrial packaging for rough handling. Goods could be embedded in polyurethane foam and a reinforced sealing shell sprayed over it.

With contact-molded sprayups (as with contact-molded mat layups) the surface finish is poor on the free side. On the side that is in contact with the mold, however, the surface is as good as that obtained by matched metal molding. The second surface, too, can be smooth if a mating mold half or bag is used. On the other hand, contact molding with short-pot-life resins is the simplest and most attractive sprayup process. For boat making, this means using female rather than male molds in order to get hulls that are smooth on the outside.

Economic advantages

Sprayup offers a number of economic advantages over layup. The biggest is probably the savings in direct labor. In making small boats, for example, the sprayup method requires about one-fourth the direct labor of hand layup. Three men can easily make 160 lb./hr. of finished boats. All reinforced molders are familiar with the 10 to 30% waste allowance that must be made in cutting mat to fit the molding; sprayup wastes less than 5% of the glass. The fact that the glass is used in the form of rovings rather than mat—and good products can be made from the least expensive, soft-chrome spun roving—also means substantial savings in material costs. Since sprayup makes higher glass contents possible, thinner sections can be used. Of course, the right to use any of these processes does cost the user something, but this is more than covered (in the case of the Rand process) by the difference in cost between roving and mat. Depending on the type of roving and resin used, cost of direct materials and labor works cut to about 30 to 42¢/lb. of laminate.

Comparison of two processes

The Aust & Schüttler (MAS) process is similar in principle to the Rand process in that a three-nozzle gun sprays a mixture of catalyzed resin and glass into the mold. However, the MAS apparatus (Fig. 7, below) cuts the roving in a machine remote from the nozzle and blows the cut rovings to the nozzle and out of it with a stream of air. The air may be heated to speed the cure of long-pot-life resins or to dry damp surfaces to which the mixture might be applied. The MAS gun can be set up to trigger a preset "shot" of mixed resin and glass onto the mold, making it easy to control and keep track of laminate thickness. Top deposition rates are 2.4 lb./min. of chopped glass, 3.7 lb./min. of resin. As in the Rand process, the glass/resin ratio may be varied widely, and the MAS equipment offers the sometimes useful advantage that the fiber length can be varied without interrupting operation. At present the Rand process has been thoroughly tested with polyester resins and it is expected that certain epoxies will be suited to sprayup. MAS, on the other hand, asserts that "in addition to unsaturated polyester resins, all other casting resins, such as phenolic resins, melamine resins, epoxy resins, etc., can be sprayed with the equipment." Pigments and fillers can be handled by either, and with either gun it is possible to stop the glass production entirely in order to deposit a gel coat.

Skill required

While the sprayup process is relatively simple in execution as well as in principle, some skill in using the equipment is required for consistently good moldings. For best results, the glass-resin mix should be deposited in uniform layers that are not too thick, and rolling-out technique has much to do with the quality and uniformity of the finished moldings. To teach process operators some technique and give them practice, Rand has recently begun offering prospective users a one-week training course in sprayup. With regular use, skill increases, and Rand people admit that, new as the process is, some licensee employees are better at it than the teachers.



Fig. 7: The MAS gun has roving cutter located in same cabinet that holds resin tanks. Chopped rovings are blown through upper (largest) hose to gun by air stream, which may be heated to speed cure. (Photo, Aust & Schüttler)

Molding shrinkage and related effects in a fixed-cavity compression mold

Part 1

*By W. R. McGlone and L. B. Keller**

In an extension of work reported earlier (1),[1] the authors have investigated shrinkage components both in the force direction and normal to it as functions of molding conditions and material characteristics. Major shrinkage factors are elastic decompression of the molding and the difference in thermal contraction between the plastic and the mold. Usually minor factors are chemical shrinkage, anisotropy, and inclusion of volatiles. Chemical shrinkage is particularly important when cure times are small, because it is essentially a postcuring phenomenon. Shrinkage in the force direction is often different and more dependent upon molding conditions than is the lateral shrinkage. Negative shrinkage, i.e., growth, is much more likely to occur in the vertical direction. Part II of this paper will appear next month.

The "S.P.I. Plastics Engineering Handbook"(2) defines molding shrinkage as "the difference between corresponding linear dimensions of the mold and of the molded piece, both measurements being made at room temperature." Molding shrinkage, which is usually expressed as in. per in. of linear dimension, is calculated by: Shrinkage = (Mold dimension at room temperature — part dimension at room temperature) / (Mold dimension at room temperature).

There are two A.S.T.M. standards for the measurement of molding shrinkage:

A.S.T.M.-D-955-51—Measuring shrinkage from mold dimensions of molded plastics.

A.S.T.M.-D-551-41—Measuring shrinkage from mold dimensions of molded materials used for electrical insulation.

In both methods, parts are molded under specified standard conditions, allowed to cool, and measured; the shrinkage is then computed by the formula given above. In A.S.T.M.-D-955, specimens are approximately ½- by ½- by 5-in. bars, or disks 4 in. in diameter, which are measured for length or diameter, respectively, 2 to 4, 16 to 24, and 40 to 48 hr. after molding. In A.S.T.M.-D-551, the specimens are ½- by ½- by 5-in. bars which are measured for length 16 to 24 hr. after molding. In neither specification are the parts measured for height. In the work described here, molding shrinkage was measured 16 to 24 hr. after molding in both the lateral and vertical directions.

Mechanism of molding shrinkage

Both the S.P.I. Handbook and the A.S.T.M. Standards indicate that many factors, such as mold design, plasticity of material, preheating of material, temperature of mold, degree of cure, etc., may affect the measured molding shrinkage of a compound. Guzzetti(3) has given a comprehensive treatment of the effects of many of these factors.

It is the purpose of this paper to discuss some of these factors further and particularly to examine the molding shrinkage that occurs *in the height direction* in a fixed-cavity mold; and contribution of thermal expansion to molding shrinkage will also be shown. The term "landed mold" will be used in reference to a mold of fixed cavity volume (i.e., one which closes to stops). The term "unlanded mold" is used for positive molds that have no lands or stops, and whose cavity volume is determined by the amount of material in the mold.

Molding shrinkage is probably the result of the following:

1) The difference in thermal contraction between the mold and the plastics part that occurs in going from the molding temperature to room temperature.

2) Volume changes which occur because of decompression (either elastic or plastic) of the material when the pressure on the mold is released and the part is removed from the mold.

3) The chemical shrinkage of

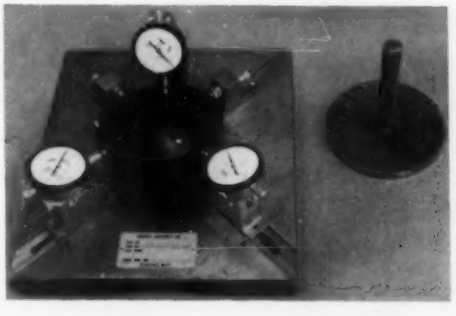
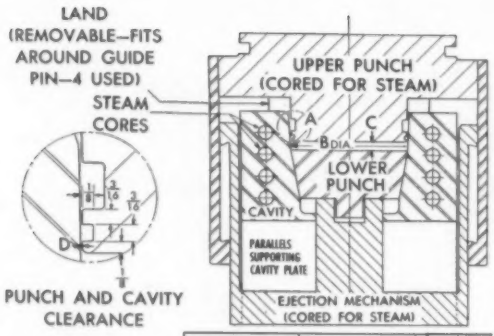


Fig. 1: Device for measuring molded specimens. Hardened steel disk at right is used for calibration

*The work reported was done at the Research Laboratories of Hughes Aircraft Co., Culver City, Calif., where Mr. Keller is still located. Mr. McGlone's present address is Plastics Div., Curtiss-Wright Corp., Quehanna, Pa.

[1]Numbers in parentheses link to references at end of article, p. 220.



DIMENSION	ROOM TEMPERATURE	300°F
B	5.256	5.264
C	0.3640	0.3645
D	0.0055	0.006

Fig. 2: Details of mold used in molding-shrinkage studies. All dimensions in inches.

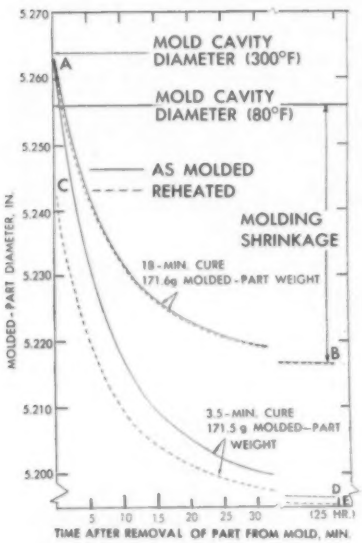


Fig. 3: Diameter *vs* cooling time of Diall 50-01 specimens

the resin as it cures. Chemical shrinkage is defined as the change in volume of the resin that is caused by the chemical reaction of polymerization.

4) Directional effects due to the orientation of fillers, or to the "memory" of filler or resin.

5) The entrapment or evolution of gases or volatiles within the plastic during molding and their loss immediately after molding. Molding shrinkage is considered to be an algebraic quantity, since it may be either positive (i.e., a true shrinkage) or negative (i.e., a growth).

Height-diameter relationship

In previous articles (1), the combination of events occurring during molding within a compression mold was examined from the viewpoint of height direction or direction of molding. It is probable that the effects discussed, such as material expansion, chemical shrinkage, decompression, etc., act also in a horizontal direction in a landed mold but not necessarily to the same extent as in the vertical or height direction. This change in magnitude would be due to three major differences between the vertical and horizontal directions in a simple, positive, landed, compression mold:

1) Decompression can first occur in the direction of molding. After the press load has been removed, the molded part is immediately free to spring back or decompress in the vertical direction, whereas it is still restricted laterally by the rigid mold until it is ejected.

2) After-molding "memory" for premolded dimensions may occur upon the removal of pressure so that growth takes place vertically and contraction horizontally. This is a logical result since the material is compressed vertically during molding and stretched or extended horizontally as it flows to the sides of the mold. This effect may also be

Table I: Materials investigated

Material	*Composition*	*Manufacturer's molding shrinkage data, in./in.*	*Manufacturer*
Diall 50-01 (green)	Orlon-fiber-filled diallyl phthalate	0.009	Mesa Plastics, Los Angeles, Calif.
Diall 794B	Short-(0.010 in.) glass-fiber and titanium-dioxide-filled diallyl phthalate	—	
Diall 51-01	Asbestos-filled diallyl phthalate	0.007	
Diall 50-52	Dacron-fiber-filled diallyl phthalate with flame arrestor added	0.010	
Bakelite BM-120 (black)	Wood-flour-filled phenolic (two-step)	0.005-0.007	Bakelite Co., New York, N.Y.
Durez 16274 (natural)	Mineral-filled phenolic (two-step electrical grade)	0.003	Durez Plastics Div., Hooker Electrochemical Co., North Tonawanda, N. Y.
Durez 1900 (black)	Flock-filled phenolic (one-step)	0.006	
Durez 1905 (black)	Flock-and-fabric-filled phenolic (one-step)	0.005	
Durez 14482 (black)	Fabric-filled phenolic (two-step)	0.002	
Heresite M-66-20 (red)	Unfilled phenolic	—	Heresite & Chemical Co., Manitowac, Wis.
Alkyd 440A	Long-glass-fiber-filled alkyd	0.001-0.004	Barrett Div., Allied Chemical & Dye Corp., New York, N.Y.

Butyrate conduit is joined easily

Using slip-sleeve couplings and solvent cement, two Kingsport Utilities crewmen laid 247 feet of a "white way" line in only 20 minutes—a fraction of the time it would take with conventional materials.





Butyrate conduit curves without fittings

To follow ditch contours in this installation, Brookville Telephone Company, Brookville, Indiana, used semi-rigid conduit of Tenite Butyrate—and eliminated the need for many right angle fittings.

Conduit of Tenite Butyrate plastic offers users many advantages

Conduit of Tenite Butyrate plastic is finding ever-growing acceptance among progressive utilities for use in carrying electric power or telephone cables.

Utilities are discovering that Butyrate is an ideal material for cable conduit. It is tough, durable, corrosion resistant and non-inductive. It can withstand all normal abuse before, during, and after installation. What's more, conduit of Tenite Butyrate is available in 20-foot lengths to reduce the number of joints in the line. The lightweight lengths can be cut with ease and joined in seconds with slip-sleeve couplings and solvent cement. Users report substantial savings in installation and maintenance.

Tenite Butyrate is a versatile plastic used in many different forms in many different fields. For more information on properties and uses, write EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENNESSEE.



Butyrate conduit resists corrosion

Tenite Butyrate was chosen by Community Public Service Company as the duct material to successfully combat the strong alkali soils found in the Pecos, Texas area.

TENITE
BUTYRATE
an Eastman plastic

Information regarding Tenite also can be obtained from local representatives listed under "Plastics—Tenite" in the classified telephone directories of the following cities: Atlanta, Chicago, Cleveland, Dayton, Detroit, Houston, Kansas City, Leominster (Mass.), Los Angeles, New York City, Portland (Ore.), Rochester (N. Y.), St. Louis, San Francisco, Seattle and Toronto—elsewhere throughout the world, from Eastman Kodak Company affiliates and distributors.

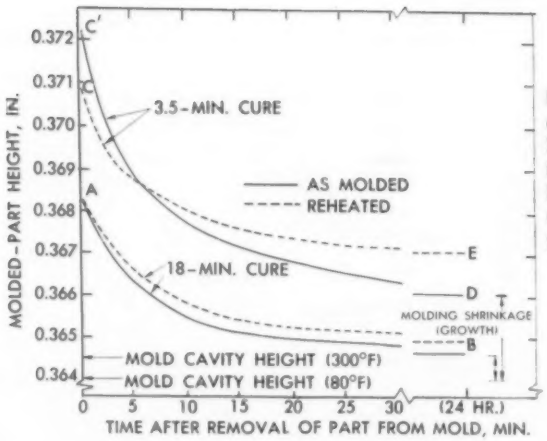


Fig. 4: Typical cooling curves for Diall 50-01, showing molded part height *vs* time after removal of part from mold

Table II: Coefficient of expansion (60 to 110° F. range)[a]

Material	*Cure*	*Coefficient of expansion-μin./in., °F.*	
		Diameter	*Height*
	sec.		
Diall 50-01	3.5	27.7	33.3
	18	28.0	34.7
BM-120	3	20.7	28.2
	7	19.9	28.2

[a] All values are averages of three repeated measurements on each of two specimens.

described as an "unmolding" action. As the amount of flow increases, the horizontal orientation and tensile stressing of fibrous fillers increase and greater "memory" effects can result. This "memory" is in addition to the expected lateral changes which may accompany the vertical growth of decompression as a result of the Poisson effect.

3) The orientation of fibers described above would also be expected to impart different values for physical properties (such as elastic modulus and Poisson's ratio) to the molded part in the two directions. Later it will be shown that this expectation can also be true of the thermal coefficient of expansion.

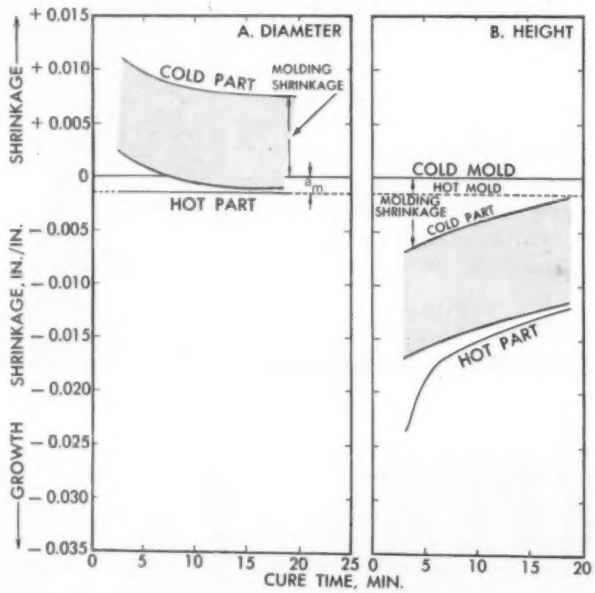
Method of measurement

As previously mentioned, molding shrinkage was investigated by studying cooling curves of molded parts immediately after they had been removed from the mold. The cooling curves are graphs of part size versus cooling time. Parts were molded from several materials and measured in the device shown in Fig. 1, p. 125, to determine the change in size as the part cooled. Diameters were measured to the nearest 0.0002 in. and thickness to the nearest 0.0001 inch. Specimens were scribed with a line corresponding to the front of the mold; this line was always placed opposite the same indicator in the measuring device so that diameters and thicknesses would always be measured at the same locations.

The specimens were molded disks (approximately 5 5/16 in. in diameter by 3/8 in. thick) which were measured immediately upon their removal from the mold and continually until they had cooled to room temperature. Each part was then reheated to the molding temperature for 1/2 hr. in a circulating-air oven so that it was free to expand in all directions and again measured for thickness and diameter at the elevated temperature. The difference between the reheated-part size (at the molding temperature) and the as-molded, 24-hr., cold-part size may be considered a measure of the thermal expansion of the part. A comparison of this expansion with the contraction immediately after molding can be used to show the amount of dimensional change in a molded part due to thermal contraction on cooling. Specific examples of this comparison will be given below.

However, the average expansion coefficients (determined over the range 80 to 300° F.) determined in this manner are not

Fig. 5: Cure time *vs* molding shrinkage of Diall 50-01



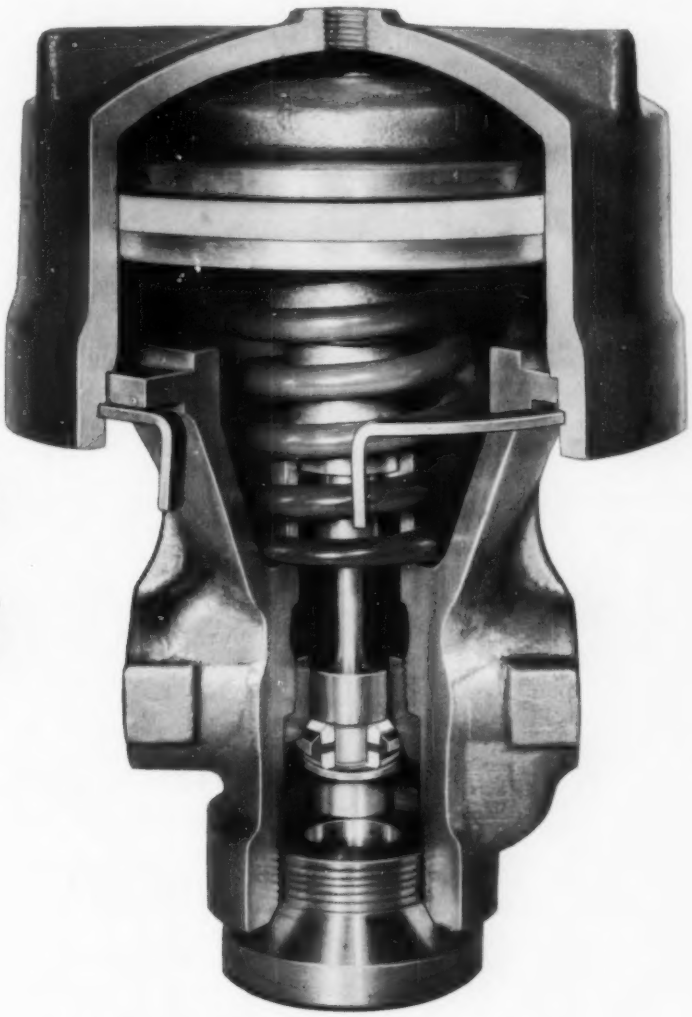
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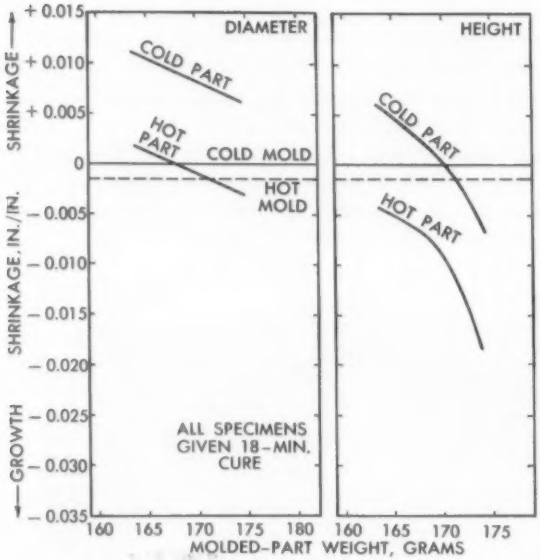


Fig. 6: Part weight *vs* shrinkage of Diall 50-01

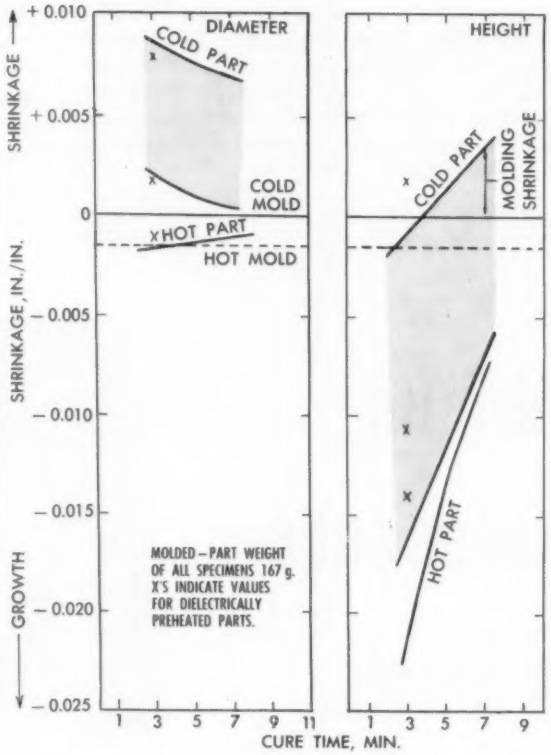


Fig. 7: Cure time *vs* shrinkage of Bakelite BM-120

exact measurements of the contraction properties of the part immediately after molding, since changes in the material may occur during the original cooling and during the subsequent reheating. The difference between the original contraction and the expansion coefficient computed from the reheating data is due to loss of volatiles, stress relief during cooling and reheating, continuance of cure of material, etc. Nevertheless, the expansion coefficients determined by this method, although they are somewhat low in value, do show that the difference in expansion coefficient between part and mold contributes considerably to molding shrinkage.

The mold used in these investigations is shown in Fig. 2, p. 126. Except where noted, parts were molded with the lands in place and at a press load of 50 tons (5000 p.s.i. based on the area of the part). Stress analysis of the mold revealed that at this pressure the maximum diametral cavity deformation would be 0.001 in. or less. A molding temperature of 300° F. and preforms 4.5 in. in diameter were used for molding all parts. Since the mold cavity was approximately 5$^{3}/_{16}$ in. in diameter, some lateral flow occurred during molding. Except where noted, a nominal dielectric preheat to 140 to 150° F. was employed, and all parts other than those made of Durez 16274 and 14482 mentioned below were considered void free when examined visually after sectioning and polishing. Table I, p. 126, lists the materials tested in this work.

Typical cooling curves

Figure 3, p. 126, shows typical cooling curves obtained by this method. The upper pair are the cooling curves for a part made of Diall 50-01 and cured for 18 min.; the solid line is the as-molded curve, and the broken line is the cooling curve after the part was reheated to the molding temperature. Point *A* represents the size of the part at the earliest time at which it could be taken from the mold and placed in the measuring fixture. This was about 10 sec. after release of pressure on the mold and 3 sec. after the part had been removed from the mold. Point *B* represents the part size 16 to 24 hr. after it was taken from the mold. Notice that the initial part size (point *A*) was within 0.001 in. of the hot-mold dimension and also that the reheating curve (broken line) nearly duplicates the as-molded curve.

The lower pair of curves in Fig. 3 refer to a part molded for 3.5 min. and made of the same material and with the same charge weight as the preceding one that was molded for 18 minutes. Here again the solid line is the as-molded cooling curve and the broken line is the cooling curve after reheating. The difference between points *C* and *A* is attributed primarily to residual chemical shrinkage which took place after the part left the mold and while it was cooling. Such shrinkage will be further discussed below. The size difference represented by the difference between points *C* and *D* is that used to compute the average thermal coefficient of expansion upon reheating.

Figure 4, p. 128, shows curves of part *height* (for the same two parts) which are similar to those shown in Fig. 3 for part diameter. The curves follow the same pattern as before, except that the curves for the part cured for 3.5 min. are now above those for the

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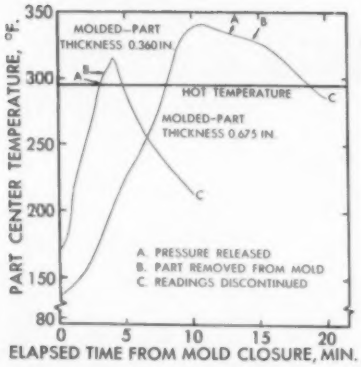


Fig. 8: Center temperature, BM-120, during cure

parts given 18-min. cures; both parts show negative molding shrinkage (i.e., growth) over both the hot and cold heights of the mold heights. The difference in height between points *E* and *B*, i.e., the change in room-temperature dimensions of the parts as a result of reheating and cooling, will be discussed below. The fact that the part cured for 3.5 min. had the greater height is reasonable. In its lesser-cured state, it sprang back or decompressed to a great extent in the vertical direction so that much of the extra volume of remaining chemical shrinkage appeared in the height and not in the diameter. Shrinkage (both residual-chemical and thermal) then took place in *both* the height and the diameter. In other words, the extra volume of residual chemical shrinkage which was released principally to the height on decompression was then lost to *both* the height and the diameter as thermal contraction and residual chemical shrinkage took place during cooling. As a result, the room-temperature height of this part was greater than the room-temperature height of the 18-min. cured part, and the final diameter was less. The fact that the shrinkage of both parts in the height direction was negative instead of positive will also be discussed.

Diall 50-01—Effect of cure time: Figure 5, p. 128, shows the effect of cure time on the diametral molding shrinkage of Diall 50-01. The graph was derived from measurements similar to those in Fig. 3 as follows:

1) The upper curve (labeled "cold part") represents the molding shrinkage of the material and is based on points similar to point *B* in Fig. 3.

2) The lower curve represents the difference between the hot part and the cold mold (in./in. of cold mold) and is based on the hot-part size (point *A* in Fig. 3). The difference between the hot-part size and the hot-mold size (in this case zero) will be shown on the graphs as the difference between the broken line (hot-mold size) and the lower curve.

3) The shaded area on the graph represents the amount of molding shrinkage known to be attributable to thermal contraction. This area is based on the thermal expansion coefficient determined by the reheating method.

In the figure, the charge weight chosen was such that the parts came from the mold at substantially mold diameter; the molded-part weight of all parts was 171.6 grams. Notice that the difference in thermal contraction between the molded part and the mold accounts for practically all of the molding shrinkage at the longer cures (shaded area minus that labeled a_m).

Continuation of cure after ejection: At the shorter cures, however, the shrinkage was greater than the difference in expansion; this effect is believed to be primarily due to chemical shrinkage which continued to take place after the part had been removed from the mold. It is known from volumetric changes within this mold during molding (3) that the chemical reaction of a similar part is not nearly complete after 3½ minutes.

Continuation of cure after ejection from the mold was demonstrated by molding several parts for 2.5 min. and 3.5 min., respectively, removing each from the mold, immediately placing it between cakes of dry ice, and determining its specific gravity by weighing it in air and water. The mean specific gravity at 25° C. for 18-min. cure (non-chilled) was 1.3446, for 3.5-min. cure (dry-ice chilled) it was 1.3446, and for 2.5 min. cure (dry-ice chilled) it was 1.3403. The difference in specific gravity between 1.3446 and 1.3403 is equivalent to a change of approximately 0.001 in. in height or 0.0075 in. in diameter.

The results substantiate that chemical shrinkage continues after a part has been removed from the mold, since it was possible to inhibit the reaction of the parts cured for 2.5 min. and show that they had a lower specific gravity and therefore a larger specific volume than the longer-cured, unchilled parts. These data also indicate the difficulty of halting the reaction once it is under way, as shown by the 3.5 min. cured parts.

If cure did not continue after a part is removed from the mold, it would be necessary for the coefficient of expansion to be as much as 25% higher for the shorter-cured parts (Fig. 5, p. 128) to account for their higher shrinkage from the hot-part size. The average coefficient of expansion between 60 and 110° F. for parts cured 3.5 and 18 min. was determined by heating them in a

Appendix I

Interrelationship between changes in height and diameter of a disk of constant volume:

The volume *V* of a right circular cylinder is

$$V = \pi D^2 h/4$$

where D = the diameter and h = the height.

Solving this equation for D^2:

$$D^2 = 4V/\pi h$$

Differentiating both sides with respect to h (V assumed constant),

$$2D\frac{dD}{dh} = -4V/\pi h^2$$

$$\frac{dD}{dh} = -2V/\pi Dh^2$$

but $V = \pi D^2 h/4$

so $$\frac{dD}{dh} = -\frac{D}{2h}$$

Since $$\delta D = \frac{dD}{dh}\delta h$$

$$\delta D = -\frac{D}{2h}\delta h$$

For the disks molded in this study $D \cong 5.10$ in., $h \cong 0.36$ in., $dD/dh = -5.10/0.72 = -7.1$

Thus a given change δh in the height requires an opposite change in diameter of about 7 times δh, if constant volume is to be maintained.

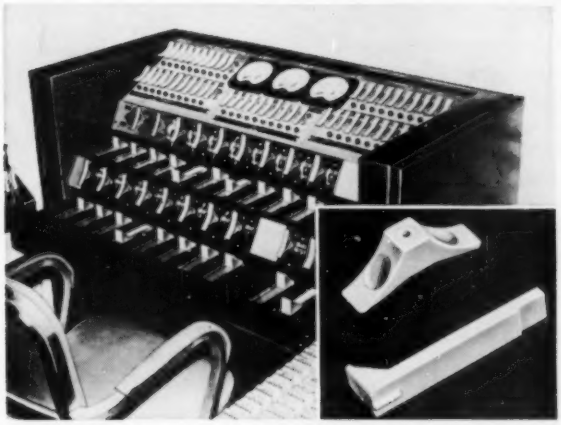
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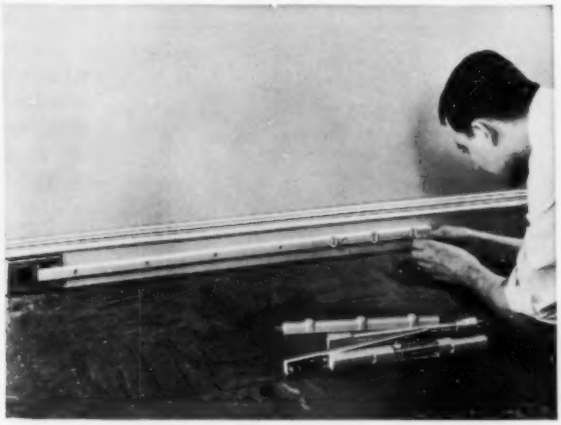
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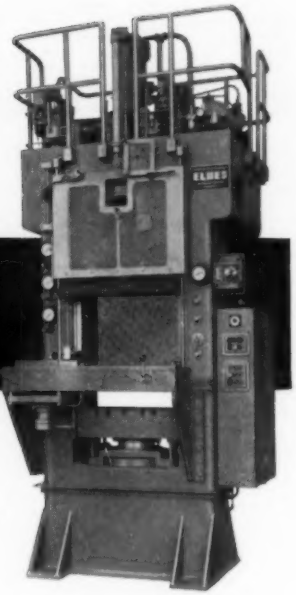
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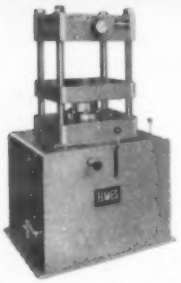
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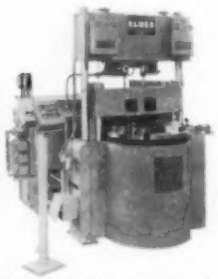
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constant-temperature bath, removing them, and immediately measuring them on the device shown in Fig. 1. This procedure was also followed for the Bakelite BM-120 material to be discussed later; the data obtained are given in Table II, p. 128. The diameter values obtained for BM-120 agree well with those given in Reference 5 for wood-flour-filled phenolic.

The temperature range chosen (60 to 110° F.) was low enough that further cure should not occur during testing in the exposure times involved (10 min. per cycle). Since the expansion properties of the Diall 50-01 parts with the long and short cures were practically the same, the 25% difference in shrinkage noted above is considered to be due to continuing cure after removal of parts from the mold.

Figure 5 shows dimensional changes in the height direction versus cure time for the same parts. Here the molding shrinkage was negative (growth). Growth rather than shrinkage took place since the thermal contraction and continued chemical shrinkage were not sufficient to overcome the large decompression occurring upon release of pressure.

Diall 50-01—Relationship between shrinkage and molded-part weight: The effects of increased molded-part weight on the molding shrinkage of parts cured 18 min. are shown in Fig. 6, p. 130. Charge weight is not used since it does not take into account the amount of material eliminated during molding. The actual weight of material remaining in the mold after closure is the better criterion. The molded-part weight varied directly with charge weight, so that the effects described are also the result of changes in charge weight; however, the ratio of molded-part weight to charge weight is definitely not constant (e.g., for a charge weight of 165 g. the molded-part weight was 164.5 g. and for a 182-g. charge it was 173.3 grams). In many cases large dimensional variations are encountered from part-to-part or from batch-to-batch of material, and molders would be well advised to check for variations in molded-part weight.

As can be seen from the figure, molding shrinkage in both height and diameter decreased with increasing molded-part weight. Notice that the molding shrinkage in the height direction goes from positive (shrinkage) to negative (growth) as the mold is packed with material. Notice also that the difference between hot-mold dimension and hot-part dimension changes (both in height and diameter) with part weight. This difference (which, when negative, is principally due to decompression) is much larger in the height direction. This is perhaps due to lack of hydraulic transmission of pressure in the mold and to differences in physical properties, such as modulus of elasticity and Poisson's ratio in the two directions as a result of fiber orientation, or perhaps it is caused by plastic flow occurring vertically during ejection (at the high part weights) since the part may be restricted laterally by the mold. Some of the differences between hot mold and hot part may also be attributed to the memory effect previously described.

Thus, for Diall 50-01, a greater amount of the extra material (i.e., the increased charge at the high part weights over the low) goes into the cold-part height rather than into the diameter; in other words, the height increases in greater proportion than the diameter. This is also true on a volumetric basis since at about the volumes considered, a change of 0.001 in. in height is equivalent to approximately a 0.007-in. change in diameter (see Appendix I, p. 132).

The range of charge weights used effectively covers the range over which good-appearing parts could be obtained and over which the mold remained closed to lands throughout the molding cycle. A range chosen on the same basis

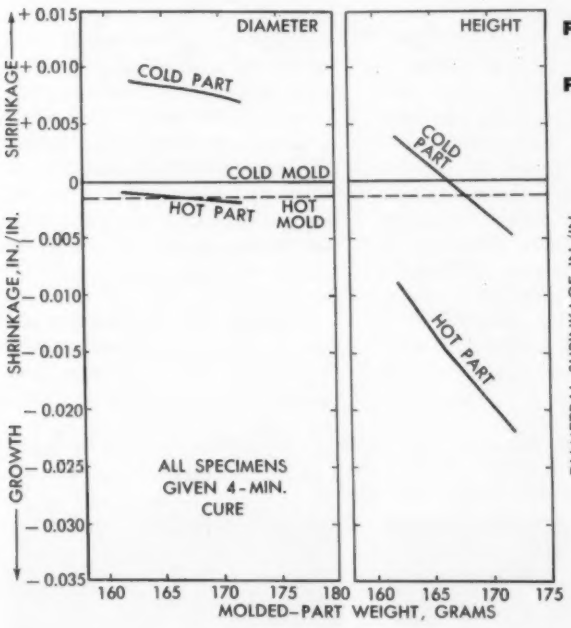
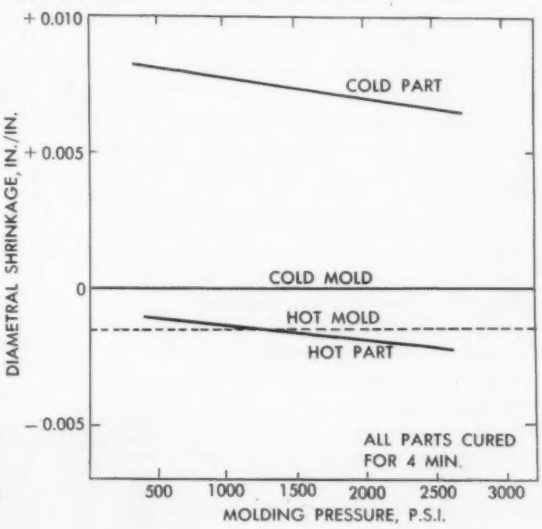


Fig. 9: Weight *vs* shrinkage of Bakelite BM-120

Fig. 10: Shrinkage of BM-120 in unlanded mold



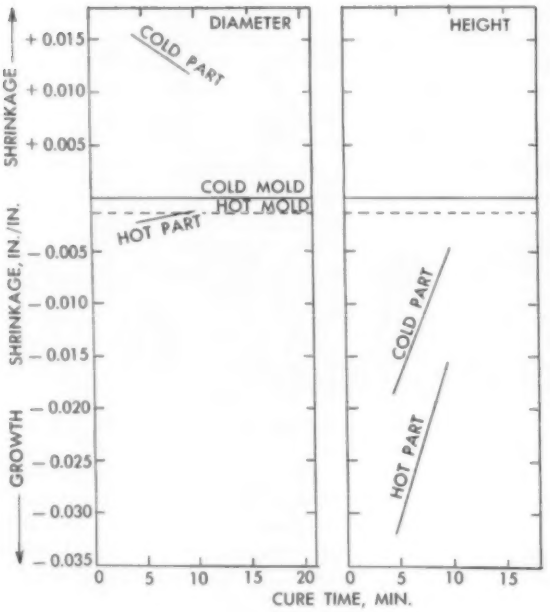


Fig. 11: Cure time *vs* shrinkage of Heresite M-66-20

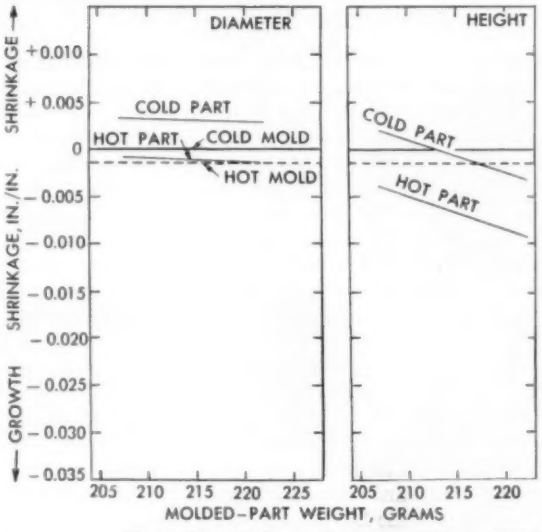


Fig. 12: Weight *vs* shrinkage of Durez 16274

was used for the other materials discussed below.

Bakelite BM-120—Effect of cure time: Figure 7, p. 130, shows the effect of cure time on the molding shrinkage of this material. Again, as in the case of the Diall 50-01 material, the molding shrinkage decreased with cure time. This effect has previously been observed by the authors (5) and Guzzetti (3). Most of the effects shown here are similar to those described for Diall 50-01; the lateral molding shrinkage is primarily due to the difference in the expansion of mold and molded part except at the lower cure times, when residual chemical shrinkage may be important. The molding shrinkage in the height direction is principally the algebraic sum of the decompression and the thermal contraction. The decompression is the difference between the hot-mold and hot-part curves in Fig. 7.

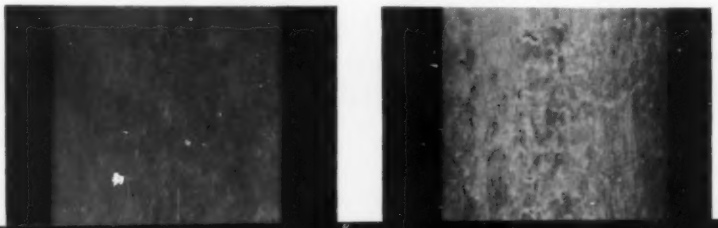
The amount of shrinkage accounted for by thermal contraction (shaded area on graph) is less well defined for this material because considerable cure and loss of volatiles probably take place during reheating even at the longer cures. However, much of the increased amount of shrinkage at the lower cures (not accounted for by the thermal expansion found by reheating) may be attributed to a continuance of cure immediately after removal from the mold. This contention is substantiated by the low-temperature coefficient-of-expansion data in Table II. Here, as in the case of the Diall 50-01, the difference in expansion properties for parts with long and short cures was insufficient to account for the difference in the molding shrinkage of these parts.

Center temperature of molded parts: The probability that additional chemical shrinkage occurs after ejection was further demonstrated by measuring the center temperature of molded parts while they were still in the mold during curing and also after ejection during cooling. This was done by inserting a thermocouple between two preforms in a hand mold and then molding at 2500 p.s.i. and 295° F. Of the two parts molded, one had a thickness of 0.360 in. and the other 0.675 inch. The preforms were dielectrically preheated to 170 and 135° F., respectively. The data are presented in Fig. 8, p. 132. Notice that both materials showed higher peak center temperatures than the actual mold temperature because of the exothermic character of the curing reaction; notice also that both materials remained above a reasonable curing temperature (e.g., 250° F.) for several minutes after their removal from the mold. The 0.360-in.-thick part even showed a center temperature *increase* after it was removed from the mold; the other part was removed from the mold after the exotherm peak had been passed. The fact that center temperature remained at a level that was high enough to sustain curing for some time after removal from the mold indicates that parts may receive cures in excess of those occurring during actual molding times. It should be recalled that the center is the last portion of a part to cure; it is also the last portion to cool. These effects may be exaggerated in thicker parts.

Shrinkage of preheated part: Data for a part preheated dielec-

(*To page* 219)

Fig. 13: Cross sections (3.7X) of specimens molded of Durez 16274. Weight of the molded part at the left is 220 g.; part at the right weighs 208.2 grams.



'Formolding' acrylic sheet

Dry acrylic sheets, preferably straight from the extruder, are heated to 390° F., then formed by compression in 200° F. mold to give thin-walled parts that would be difficult to injection mold.

The maximum size and minimum thickness to which acrylic can be injection molded are limited by the flow characteristics of the hot resin in the mold. For example, to insure proper filling of large-area molds, it is often necessary to use a greater thickness than is actually needed for the service requirements of the application. Another technique is to use an injection molding machine which has a much greater rated capacity than the weight of the part, in order to obtain the greater clamping forces available in the larger machine and thus permit the raising of injection pressures.

It has been found that a modified compression molding process called "formolding" will overcome some of these size, thickness, and flow limitations. The process (Fig. 1) consists of:

1) Preheating an extruded acrylic blank to about 390° F.

2) Transferring the hot blank quickly to a warm (200° F.) mold mounted in a hydraulic press.

3) Shearing the blank to mold size and forming it to the mold contours in one continuous motion.

4) Holding the part under pressure until it cools sufficiently to hold its shape.

5) Ejecting the finished part.

The process simulates injection molding in that a warm mold is used for shaping and cooling, but differs in that it requires only contour flow and flow into surface details and does not require as much lateral flow in the mold. For this reason, pressures are somewhat lower than those required for injection molding.

An important consideration in the design of parts to be formolded is the amount of material which must be "flowed" during molding and the average distance it flows. In other words, the degree of difficulty of a formolding job is related to the difference between the maximum and minimum thickness of any area of the part and the frequency with which this pattern is repeated over the surface of the part. For example, a textured part having a closely repetitive pattern over most of its surface would be easier to produce by formolding than a flat panel having only one or a few widely spaced heavy ribs.

Regardless of the design of the part, the following practices must be observed to get the best flow characteristics in the material:

1) Thickness variation in the blank should be kept within narrow limits, preferably no greater than ±10 percent. Sudden changes in thickness of the blank should also be avoided.

2) The extruded blanks should be heated to the highest temperature possible without bubbling.

3) The forming mold should be 200° F. or higher, consistent with reasonable cooling times.

4) The heated blanks should be transferred to the press as fast as possible to minimize heat loss.

5) The molding operation should be performed rapidly so that the plastic will flow at the highest temperature possible.

Predrying

Since the flow characteristics of extruded acrylic improve with increasing temperature, it is essential to heat the extruded blank to as high a temperature as possible, short of causing the sheet to bubble. The maximum temperature is limited by formation of bubbles in the resin. The temperature at which bubbles begin to form depends on the moisture content of the blank. The lower the moisture content, the hotter the blank can be heated without bubbling.

Tests have shown that acrylic sheets which have been stored several weeks after extrusion and thus allowed to pick up moisture could be preheated to only 360° F. before bubbling. On the other hand, similar sheets which were removed from storage and dried at 210° F. for 12 hr. could be heated to at least 390° F. without bubbling. Newly extruded Plexiglas V sheets could also be heated to 390° F. without bubbling because they are rela-

(*To page* 140)

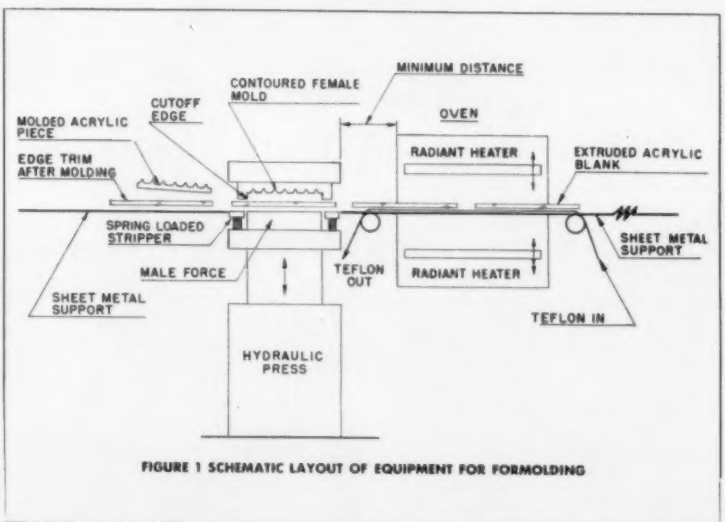


FIGURE 1 SCHEMATIC LAYOUT OF EQUIPMENT FOR FORMOLDING

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Specific gravity	D176-42T	1.18—1.21
Tensile properties:		
Yield (p.s.i.)	D638-52T	3380—5020
Break (p.s.i.)	D638-52T	3470—5240
Elongation (%)	D638-52T	56—66
Flexural properties:		
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Flexural modulus (10^5 p.s.i.)	D790-49T	0.23—0.30
Rockwell hardness: (R scale)	D785-51	62—94
Izod impact: (ft. lb./in. notch)	D256-43T	2.7—11.0
Heat distortion: (°C.)	D648-45T	59—70
Water absorption:		
% sol. lost	D570-42	0.00—0.08
% moisture gain	D570-42	1.5—1.8
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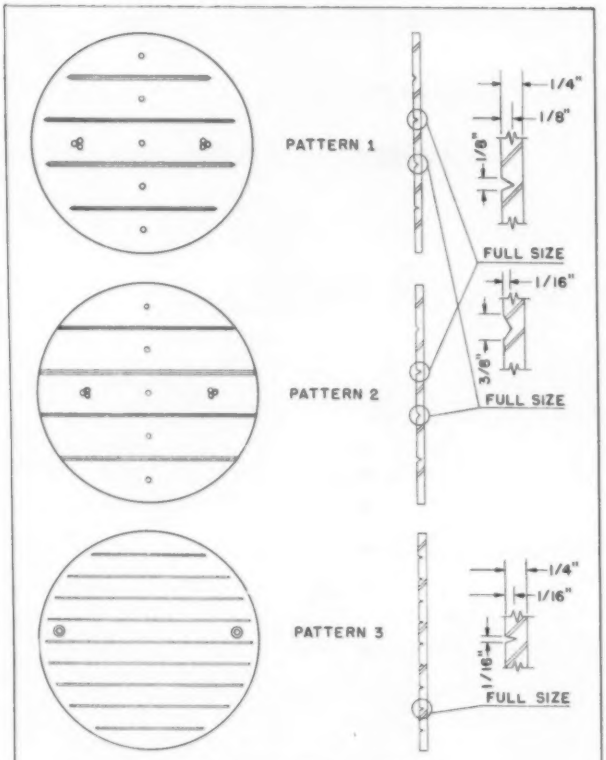


FIGURE 2 CONFIGURATION OF MOLDS

tively free of absorbed moisture.

A circulating air oven with some bleed of the oven air and addition of dry make-up air will do a good drying job.

Heating the sheet

After predrying, either infra-red heating or forced-circulation air oven heating can be used to heat the extruded acrylic blank to formolding temperatures. Regardless of the method used, the temperature and time cycles should be carefully controlled so that the center of the sheet becomes fully heated.

Infra-red heating: The principal advantage of infra-red heating over air-oven heating is speed of heating. For example, radiant heating time cycles for ⅛-in. extruded acrylic sheet heated from one side only may vary from 1 to 3 min., depending on the type of heater and the distance from the heating surface to the acrylic; this may be compared with 10 to 15 min. for air-oven heating. Temperature uniformity also varies with the type of heater used. Heaters with more uniform surface temperatures can be held closer to the acrylic sheet.

Because of the high surface temperature (usually 600 to 1000° F.) of the heaters and the large amount of energy radiated from them, infra-red heating time is critical and must be controlled within a few seconds to avoid bubbling the sheet.

Air-oven heating: Air-oven heating has the advantage of more uniform temperature control and minimum danger of overheating the sheet. The oven should be insulated against heat losses and provided with a system of forced-air circulation and suitable baffles to distribute the heat evenly throughout the oven. Air velocities across the surface of the sheet should be in the range of 150 ft./min.

Supporting the sheet

Extruded sheets heated to formolding temperatures are too soft and flow too readily to be hung from clamps in the heating oven. For this reason, they must be fully supported horizontally during the heating cycle.

A steel tray may be used. However, since the hot sheets will stick to the metal, the tray should be covered with a film of Teflon, the thickness of which can be kept to a minimum, since it serves only as a release agent. A practical solution is to transport both the acrylic and the Teflon through the oven and to peel the Teflon from the hot acrylic just before it is placed in the mold. In production, the same results might be accomplished by the use of a continuous moving Teflon belt riding on sheet metal surfaces and passing through the heating oven.

For best results, the heated blanks should be transferred to the molding press and the compression portion of the molding cycle completed as rapidly as possible. The total time for these two actions should probably not exceed 5 to 10 seconds. To keep this time at a minimum:

1) The oven should be placed adjacent to the mold and the oven surface supporting the blank should be level with the mold.

2) The mold halves should be opened only enough to feed the heated blank between them.

3) A means for pulling the sheet from the oven and between the mold halves quickly should be provided.

Mold design

The mold should be designed as a positive type in which the edges will shear the extruded blank to the size of the cavity as the mold is closed.

The surface patterns which can be molded depend on the amount of flow required, the temperature of the blank and the mold at the time of molding, the maximum pressure available, and thickness variation in the blank.

Tests made on several mold patterns, as illustrated in Fig. 2, above, show the effect of surface pattern design on moldability. Pattern 1 was most difficult to mold because of flow and air entrapment in the grooves. Satisfactory parts could not be molded at a pressure of 2900 p.s.i. on the material and a mold temperature

(*To page* 222)

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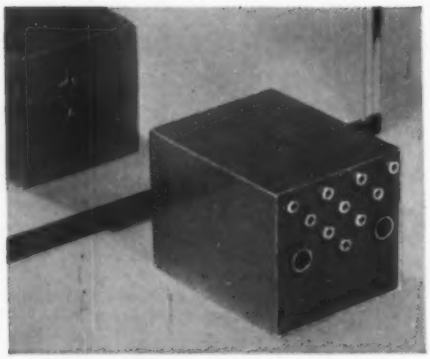
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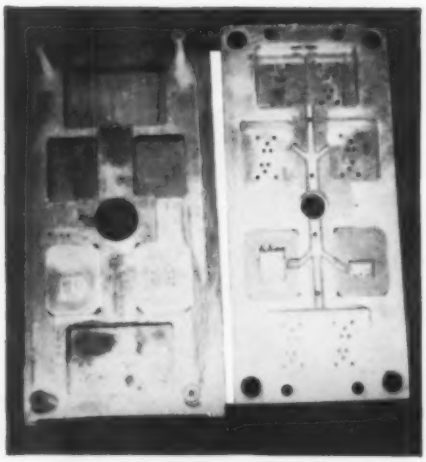
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Measurement of stresses in cast resins

By A. J. Bush†

The method described in this paper measures internal stresses in a cylindrical resin casting. This information enables the manufacturer or designer to choose the type of casting resin, the type of filler, the amount or type of catalyst, and the rate of cooling that are most applicable for his needs.

Many failures due to cracking in cast resin products could be prevented if the manufacturer could determine internal stresses in the casting. This is especially true in potting applications, where mechanisms are encased in a resin to protect them from mechanical damage and from moisture. Curing of the resin or exposure to low temperature sets up internal stresses large enough to cause the resin to crack. A.S.T.M. or MIL specifications contain no reliable test methods that provide either information as to the magnitude of stresses in a casting or a direct numerical comparison of one potting material to another.

A strain-sensing element must meet a number of interrelated requirements. It must operate in both a liquid and a solid, because resins exist in both states. It must be stable over a wide temperature range. Not only must the sensing element perform at the upper temperatures encountered in resin curing—about 135° C. (275° F.)—but also at sub-zero temperatures where certain potted electronic mechanisms must operate. Under these conditions, the sensing element must be sensitive to and measure accurately very small changes in strain, of the order of 5 p.s.i. And finally, ease of calibration is necessary at operating temperature and pressure ranges.

The element developed to meet these requirements consisted, essentially, of a cylindrical steel tube having wire strain gages bonded to its inner surface. When potted in a resin, this tube is subjected to the internal forces in the casting. The resulting strains in the tube are measured by the bonded wire strain gages. When the tube is potted in a resin casting having cylindrical symmetry, these strains can be easily calculated into the forces acting in the casting.

The tube was made from standard 1-in.-O.D. stainless steel having a nominal wall thickness of 0.050 inch. Both internal and external surfaces were ground concentrically to a wall thickness of 0.035 inch. This was found to be thin enough to give the required sensitivity, yet rigid enough to permit mounting of gages and subsequent handling without

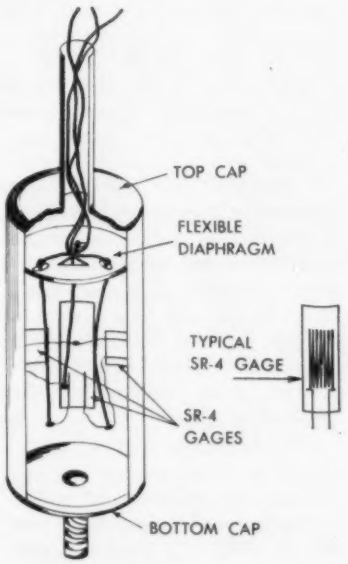


Fig. 1: Cut-away view of sensing element

*Reg. U.S. Pat. Off.
†Materials Engineering Dept., Westinghouse Electric Corp.

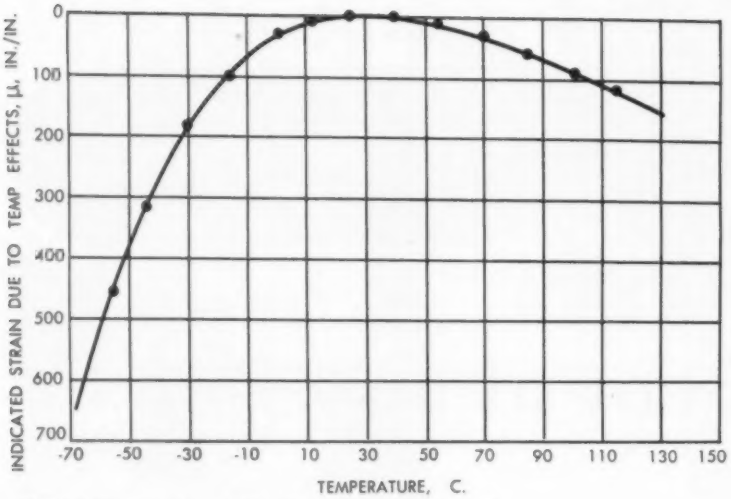


Fig. 2: Temperature calibration of sensing element

suffering permanent deformation. The tube was finished to a length of 2 in., with both ends ground perpendicular to the tube axis.

The bonded wire strain gages used were of the SR-4 phenolic type, which can be used up to 260° C. (500° F.). Paper-backed gages would be easier to mount but are not stable at temperatures much above ambient. Proper mounting of the gage requires it to be baked for 5 hr. under a clamping pressure of 100 p.s.i. A jig had to be made in order to mount the gages properly. Gages mounted in the tube are oriented to measure both longitudinal and radial strain (Fig. 1, p. 143). To measure the radial strains, two gages are mounted circumferentially, 180° apart, at mid-length of the tube. One other gage is mounted between these two, also at mid-length, and oriented longitudinally to measure strains in that direction. The gages were heated and preformed to the contour of the tube before being cemented in the conventional manner. Clamping pressure was obtained by a system of wedges on the circumferential gages and by a steel bar of semi-circular cross section on the longitudinal gages.

After baking at 190° C. (375° F.) the complete sensing element was placed in an oven and cycled between room temperature and 205° C. (400° F.) several times. This cycling completely cures the phenolic resin and cement and stabilizes the gages. They will not drift when put under strain, and will return to the same zero reading when strain is removed.

Next, temperature and hydrostatic-pressure calibrations were made on the sensing element. The temperature calibration was necessary because a temperature-compensating gage could not be used. A temperature-compensating gage could not be placed anywhere in the sensing element so that it was always in temperature equilibrium with the active, or measuring gages, without submitting it to forces exerted by the resin. The hydrostatic calibration was made to obtain experimental correlation between the strains indicated by the sensing element and variations in hydrostatic pressures applied to it.

Temperature calibration was accomplished in a circulating-air oven whose temperature could be easily regulated and held within 0.5 degree C. of any desired temperature. The sensing element was placed in the oven and connected to wire leads extending to the outside through openings in the oven wall. Normally, the temperature-compensating gage is used to complete the bridge circuit. Since a compensating gage could not be employed in this application, the bridge was completed by a gage placed outside the oven and connected by leads extending through the oven wall. A change in the temperature of this gage would change its resistance and result in a calibration error. It was, therefore, sealed with wax and placed in ice water. The calibration process consisted of reading the strain indicated by the sensing element from −65 to 110° C. at intervals, strain readings being made after the tube was exposed to a temperature long enough for entire assembly to attain that temperature.

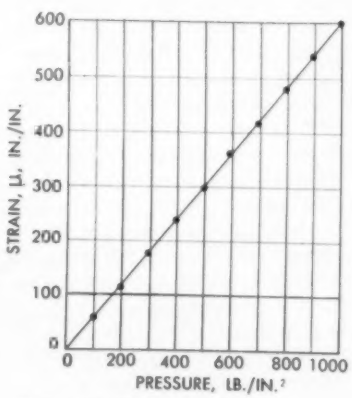


Fig. 3: Typical strain-pressure calibration curve

The calibration curve of strain-versus-temperature reverses its slope (Fig. 2, above). It was found that the shape of the curve is characteristic of the gages, with the change in slope resulting from a change in sign of the thermal coefficient of resistivity of the gage element. Since the curve is flat around the zero point, no temperature correction is necessary for room temperature readings, even though room temperature should vary a few degrees during the test.

Next, the sensing element was calibrated for hydrostatic pressure. This was done at room temperature in a small pressure chamber made especially for the purpose. The pressure source was commercially available equipment designed for calibrating hydraulic gages, and accurate to within 2 p.s.i. The sensing element was calibrated in the range 0 to 1000 p.s.i. (Fig. 3, left).

Prior to making a test, a cap is placed on either end of the tube to prevent resin from flowing into the tube. There is a clearance of several thousands of an inch between the caps and the tube I.D. so that the caps offer no restraint

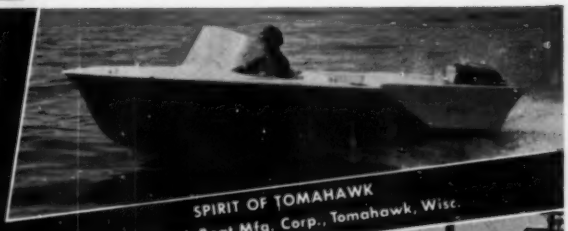
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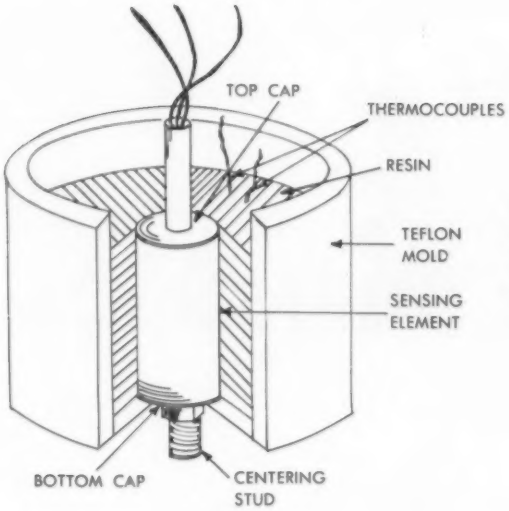


Fig. 4: Cut-away view of mold, showing resin, sensing element, and other details of set-up

to radial forces acting upon the tube (Fig. 4, above).

A Teflon mold which does not adhere to the resin, thus permitting the removal of the casting, is used in evaluating resin strains with the sensing element. Machined in the bottom of the mold are a hole for the centering stud and an insert for the bottom cap to seat. A nut and washer, applied from the outside, hold this cap firmly in the center of the mold. The bottom of the mold is removable to facilitate the extraction of the resin and the tube from the mold. With the sensing element in position in the mold, the liquid resin is poured into the mold so that it reaches a level with the top of the tube. Two thermocouples, centered longitudinally, are embedded in the resin; one is butted against the outside of the sensing tube, while the other is located halfway between the outer wall of the tube and the outer wall of the casting. The thermocouples are used to measure the gradient inside the resin, and to establish the temperature for which strain readings are taken.

During curing, or thermal cycling after curing, time, strain and corresponding temperature readings are taken. Each pair of strain and corresponding temperature readings is referred to the strain-versus-temperature curve obtained from the temperature calibration. The proper correction for that temperature is applied, then this corrected strain is referred to the strain-versus-pressure curve obtained from the pressure calibration. This gives the magnitude of the force and thus the stress acting upon the tube. The stress in the casting at the tube wall is then known since it is the same as the stress acting upon the tube.

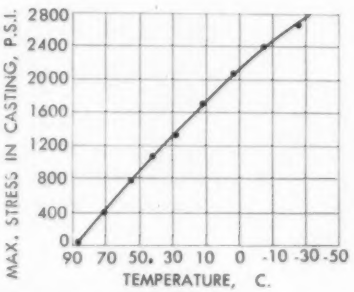


Fig. 5: Typical stress-versus-temperature curve for a rigid resin

A temperature cycle is used on various resins to gather further stress information. The cycling is started after the resin has been cured, the polymerization stress readings have been taken, and the resin and embedded tube have been removed from the mold. Various temperature cycles can be used; the device has been used very successfully in a cycle that varies from 85 to −65° C.

After the completion of the temperature cycle, the maximum stress in the casting is calculated using the strain readings, temperature readings, and the temperature and the pressure calibration curves. This stress is then plotted as a function of temperature (Figs. 5 and 6). Figure 5, left, shows the curves of a rigid-type resin where the stress, as a function of temperature, is essentially a straight line over the entire temperature range. Figure 6, below, represents a flexible-type resin in which there is no stress present until the temperature is lowered to some transition point at which the resin becomes rigid. As the temperature is lowered still further, the stress in the resin increases rapidly until the curve approaches a straight line.

The sensing device has been

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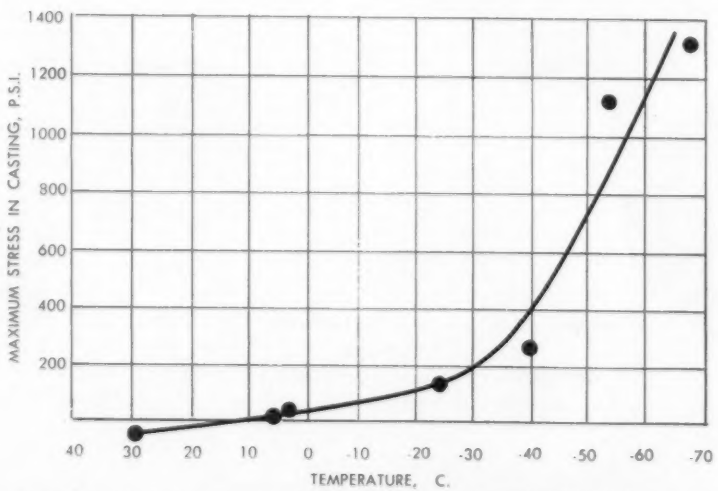
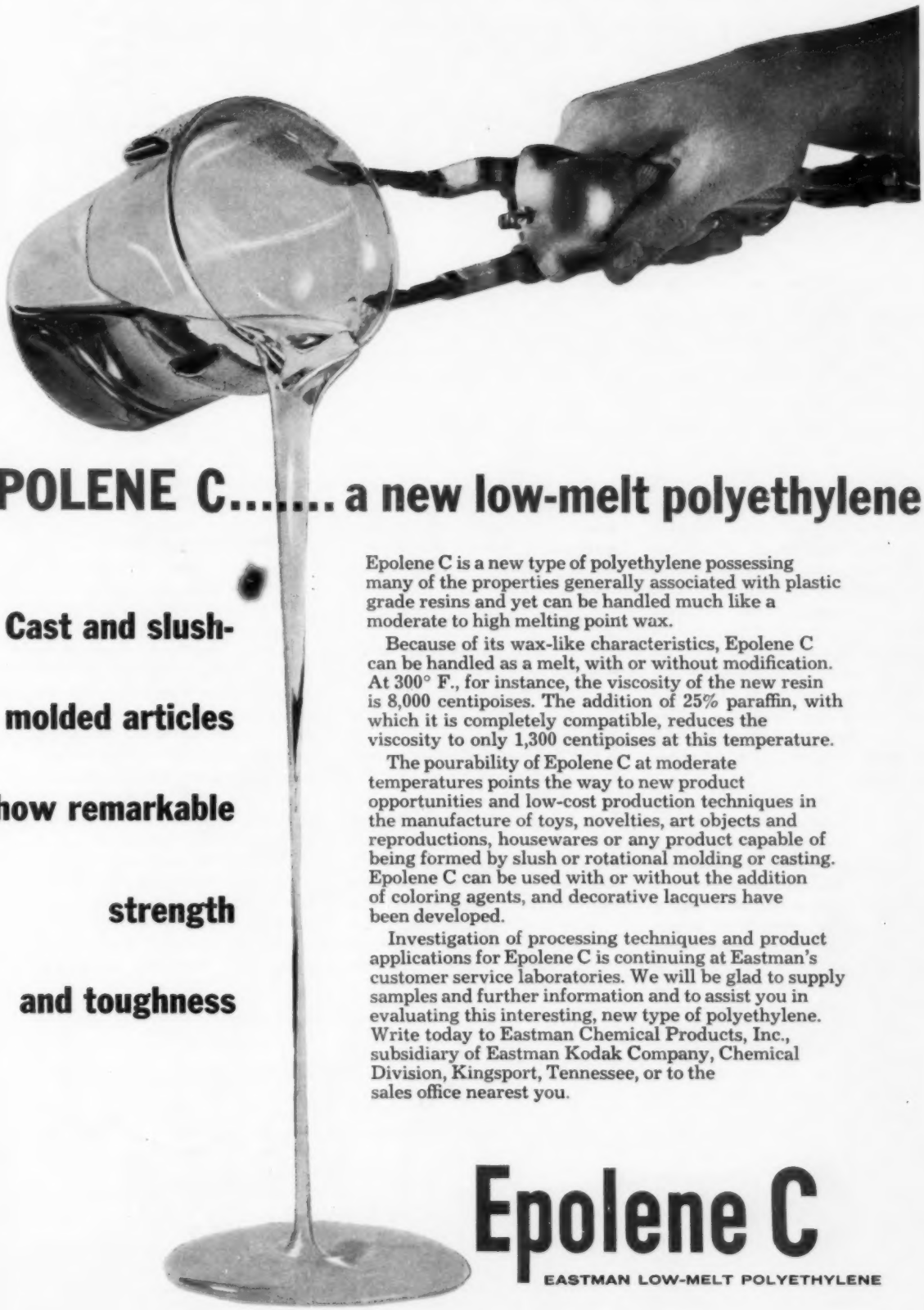


Fig. 6: Typical stress-versus-temperature curve for a flexible resin



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Evaluation of casting resins employing strain gage techniques

By R. N. Sampson and J. P. Lesnick**

The strain-sensing procedure described by A. J. Bush (see p. 143) was utilized to study casting resins. This technique for quantitatively determining the stresses produced by a casting resin on an embedded component provides a sound basis for selecting and compounding casting resins and for maintaining quality control on these resins.

A casting resin undergoes little change until it is activated by the addition of a catalyst (hardener) or application of heat, or both. The resin system then "cures" into a rigid, infusible mass. The history of the stresses imposed on embedded components during this process is of particular interest, and therefore the first attempt to use the strain-gage method was in recording the stresses of a resin during polymerization.

Many resins are such that with improperly chosen catalysts they readily crack while curing. Figure 1, below, illustrates the behavior of an unfilled polyester resin of this type. The portion of the curve from *A* to *B* represents the initiation period during which little change in the viscosity takes place. At point *B* the resin begins to cure rapidly with attendant increase in viscosity and the liberation of heat. The resin cracked at point *C* some 75 min. after the addition of catalyst. The line to the right of the point *C* illustrates the decrease in compression stresses as the resin cooled and the cracks propagated through the casting. The slope of the curve from *B* to *C* is radically influenced by the resin system. In general, all polyesters react quickly once the initiation period is over, and the slope of the curve is therefore quite steep. Amine-cured epoxies exhibit a similar behavior, but anhydride-cured epoxies usually have a much more gentle slope, taking a prolonged time to cure completely.

*Materials Engineering Dept., Westinghouse Electric Corp.

Gelation point

The curve for an epoxy resin with an anhydride curing agent, which did not fracture while curing, is illustrated in Figure 2, p. 153. The inflection point *B* in Fig. 2 has been somewhat arbitrarily defined as the gelation point. This is the point where polymerization begins. In practice, thermocouples are inserted in the resin to measure the temperature caused by the exothermic heat. Since the resin is a poor conductor of heat, a large gradient often exists between two thermocouples and between strain gages and the thermocouples. In all probability, polymerization stresses begin first somewhere in the interior of the resin casting and propagate inward toward the strain sensing tube and outward toward the wall of the mold. Hence, it is difficult to determine the real point at which solidification, with the accompanying pressure on the strain gages, actually begins.

Polymerization stress

Referring again to Fig. 2, the curve straightens out after some 140 min., and no further change of stress takes place with increasing time. This is the final stress that remains in the casting after all curing has been completed. At this point, the exothermic heat of the reaction has been dissipated and the temperature of the casting has returned to that of the environment. This stress value is designated as the polymerization stress; for this example its value is 255 p.s.i. Long-time aging, in some cases as long as six months, has demonstrated that this stress does not change with time when the casting has been satisfactorily cured in the first place. The stress,

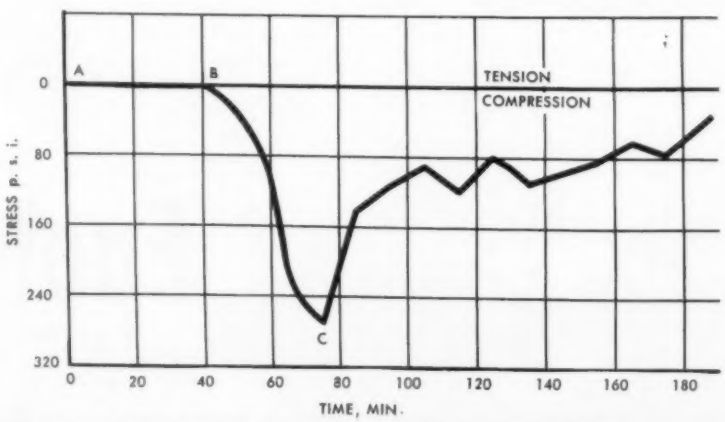


Fig. 1: Stress-versus-time curve for an unfilled polyester resin

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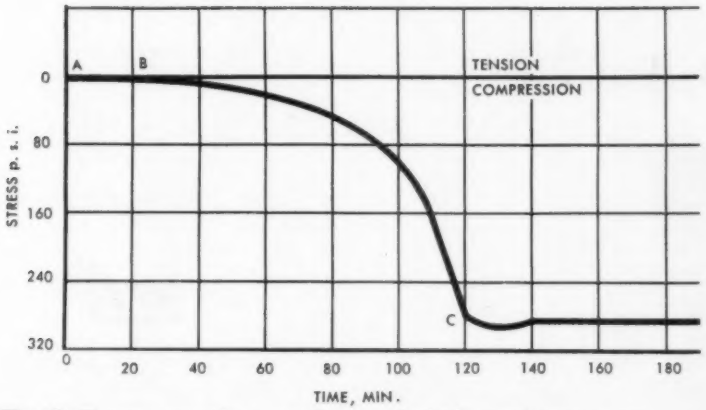


Fig. 2: Stress-versus-time curve for an anhydride-cured epoxy resin

however, can be altered by changing the environmental conditions such as the temperature and in some cases the humidity. In many instances, a slight dip in the curve occurs near point C in Fig. 2. This is assumed to be brought about by temperature changes as the resin cools and by some relief of stress within the casting.

Effects of thermal cycling

Once a resin has been completely cured and the polymerization stress measured, castings can be cycled through a wide variety of different environments, and the stresses can be determined for any set of conditions. This technique has proven to be very useful because some military specifications insist on reliable performance of cast components at temperatures ranging from −100 to 200° C. and higher. Figure 3, below, illustrates a plot of stress versus temperature for a rigid polyester resin. Note that the stress increases substantially with decreasing temperature. It has been postulated that this reflects the combined effects of change in the modulus of elasticity and the thermal coefficient of expansion for the resin system. Using such a curve, one can predict potential stresses in new casting applications where the shape of the prospective embedded member and the temperature are known. Obviously such information is of great value to designers of electronic components.

Stress index

The "stress index" has been empirically defined to be the slope of the stress-temperature curve at any point. Therefore, the stress index can be expressed as $\Delta S/\Delta T$. Referring again to Fig. 3, the stress index for this resin is 20 p.s.i. per degree centigrade.

The stress index is often useful for comparing resin-filler systems. The addition of fillers changes the slope of the stress-temperature curve; by this test procedure some measure of the change is obtained. In the cases where the curve is not a straight-line function, the stress indices may be calculated at various temperatures and compared over various narrow temperature ranges.

Effect of filler content

The exact effect of various amounts of fillers in resin systems is of great interest to the materials engineer. Fillers extend the resins and thus reduce the volumetric cost, but in addition they often improve the resistance of the polymers to cracking during thermal cycling. The strain gage tests can be utilized to determine accurately the effects of any change in the quantity of filler on the thermal stresses. Figure 4, below, shows the effect of varying the filler content in an amine-cured epoxy casting. It can be seen that with increasing filler content the stress at any temperature becomes lower. The stress at −30° C. in this system with 35% silica is 2600 p.s.i. compared to only 1650 p.s.i. with 65% silica.

Effect of filler types

Various fillers behave differently in any one resin. Some are more efficient in lowering the stresses during thermal cycling;

(*To page* 225)

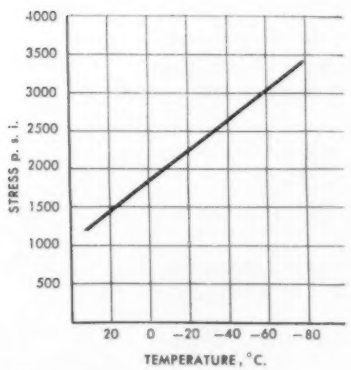


Fig. 3: Stress-versus-temperature curve for a polyester resin with mineral filler

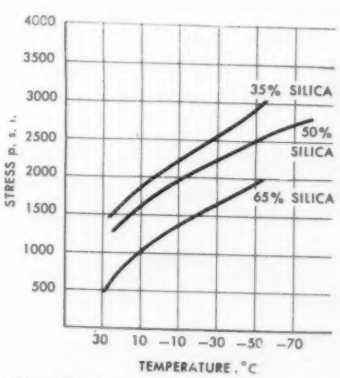


Fig. 4: Stress-versus-temperature for amine-cured epoxy resin with various amounts of silica filler

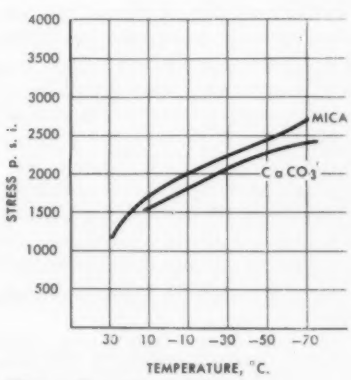


Fig. 5: Stress-versus-temperature curves for polyester resin with various fillers in 1:1 ratio

Bis(aminophenyl)sulfones as CURING AGENTS FOR EPOXY RESINS

By Walter H. C. Rueggeberg,‡ J. Edward Singley,*
Charles E. Feazel,† and Edgar A. Verchot†

Aromatic diamines, such as bis(4-aminophenyl)methane, are used as curing agents for epoxy resins, especially in casting applications in which strength of the plastic at ambient and elevated temperatures is important. In order to compare the effect of substituting the $-SO_2-$ group for the $-CH_2-$ group in the diamine, several bis(aminophenyl)sulfones were prepared and evaluated as curing agents for epoxy resins.

Most of the effort was devoted to bis(3-aminophenyl)sulfone, but similar compounds were also studied, so that the effect of the structure of the curing agent on its activity could be determined. It was found that bis(3-aminophenyl)sulfone (3APS) is a less active curing agent for epoxy resins than bis(4-aminophenyl)methane (4APM), in that the resin-catalyst mixture has a longer pot life and requires a longer time for complete curing. Epon 828,[1] when cured with 3APS, has a higher heat distortion temperature than when cured with 4APM. Presumably the sulfone group in the 3APS increases the softening temperature of the cured resin in which the 3APS has become incorporated.

In comparing the activities of substituted bis(aminophenyl)sulfones, it was found that the presence of methyl or chloro substituents in the 3APS molecule decreases the activity of the compound as a curing agent for epoxy resins, as measured by the curing rate. Also, bis(4-aminophenyl)sulfone (4APS) is less active as a curing agent than the isomeric 3APS. It was found that, in general, the activity of each compound in curing epoxy resins is proportional to its relative basicity.

Effect of structure on curing activity

The compounds that were studied are listed in Table I, below. The relative basicity of each compound was estimated from neutralization data. For comparison, 4APM was assigned a relative basicity of 100. Under the conditions used in the neutralization measurements, ethylenediamine also had a relative basicity of 100.

Table I, below, also shows the relative activity of each compound as a curing agent for Epon 828, as measured in two ways: 1) by the pot life of the resin-catalyst mixture at 60° C.; and 2) by the curing time, defined as the approximate time required for a casting of the resin to attain maximum strength when cured at 150° C. In both methods, the amount of curing agent added to the resin was the amount required for the reaction of each amino group with one epoxy group.

The strength of the cured resin was measured by a procedure similar to A.S.T.M. Method D 790-49T, but modified so that small specimens could be used. The procedure is described below.

Figure 1, p. 156, illustrates the difference in rate of cure of Epon 828 at 150° C. when different compounds are used as curing agents. The strength of a cured resin casting was used as a measure of the extent of cure. The curing-time data in Table I were taken from these or similar curves. Figure 1 shows clearly that the aminophenylsulfones are less active as curing agents than 4APM.

Since the curing of epoxy res-

Table I: Comparison of diamines as curing agents for Epon 828

Curing agent	*Potential of half-neutralization* mv.	*Relative basicity*	*Amount of curing agent used* parts/100 resin	*Pot life* hr.	*Curing time* hr.
Ethylenediamine	450	100	6	0	0
Bis(4-aminophenyl)-methane	450	100	50	1	0.5
Bis(3-amino-4-methyl-phenyl)sulfone	510	88	70	36	2
Bis(3-aminophenyl)-sulfone	520	86	62	8	1.5
Bis(4-aminophenyl)-sulfone	580	77	62	36	3
Bis(3-amino-4-chlorophenyl)sulfone	682	66	79	36	5

Portions of this work have been covered by patent application.
*Tennessee Corp., College Park, Ga.
‡Present address: Atlas Powder Co., Wilmington, Del.
†Southern Research Institute, Birmingham, Ala.
[1]A liquid epoxy resin (Shell Chemical Co.), containing about 5 moles epoxy/1000 grams.

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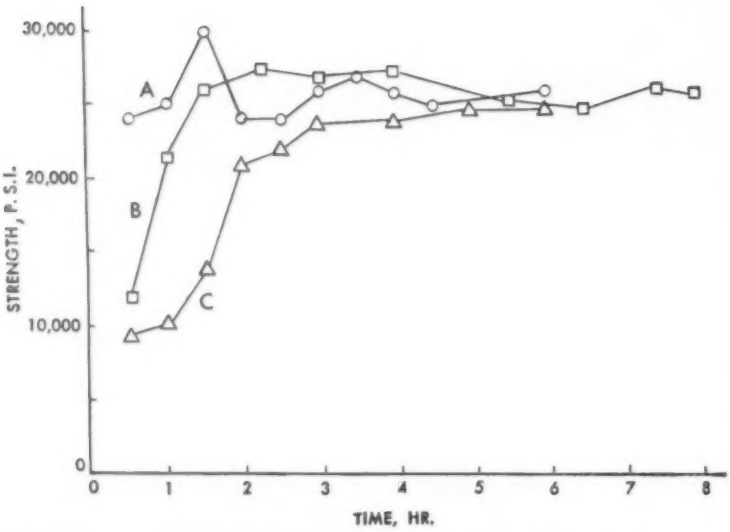


Fig. 1: Strength of Epon 828 castings versus length of time cured at 150° C. Graph A — Bis(4-aminophenyl)methane, 50 parts per 100 of resin (p.h.r.); B — Bis(3-aminophenyl)sulfone, 62 p.h.r.; C — Bis(4-aminophenyl)sulfone, 62 p.h.r

ins by primary amines presumably involves reaction of the amine group with the epoxy group of the resin, it might be expected that the rate of curing would be proportional to the basicity of the amine, as long as the substituents on the amine do not introduce steric hindrance. The results obtained with the aminophenylsulfones, as shown in Table I, are in accord with this expectation.

The decreased basicity of the aminophenylsulfones, as compared with 4APM, is probably due to withdrawal of the Lewis-base electrons from the amino nitrogen by the electron-attracting sulfone group. Furthermore, according to resonance theory, an amino group *para* to the sulfone group should be affected more than one *meta* to the sulfone group. Hence 4APS should be a weaker base than 3APS. For the same reason p-nitroaniline is a weaker base than *m*-nitroaniline. The introduction of a methyl group *ortho* to the amino group should have little effect on the basicity, whereas a chloro group *ortho* to the amino group might be expected to decrease the basicity still further. The same phenomenon occurs in *o*-chloroaniline, which is a weaker base than aniline. Experimental results agree with expectations.

As shown in Table I, the activity of the aminophenylsulfone as a curing agent is roughly proportional to its relative basicity, except for bis(3-amino-4-methylphenyl)sulfone. This compound is less active as a curing agent than would be predicted from its relative basicity. Perhaps here the methyl substituent introduces some steric hindrance to the curing reaction. The ultimate strengths obtained when Epon 828 was cured at 150° C. with the methyl- and chloro-substituted compounds are 8,000 p.s.i. and 6,000 p.s.i., respectively, compared with about 25,000 p.s.i. for 3 APS, 4APS, and 4APM.

Table II: Properties of Epon 828 cured with aminophenylsulfones

Curing agent	*Amount*	*Curing schedule*	*Flexural strength*	*Heat-distortion temperature*
	parts/100 resin	*hr./°C.*	*p.s.i.*	*°C.*
4APM	25	5/150	18,000	148
4APM	50	5/150	17,800	102
3APS	31	5/150	17,000	117
3APS	31	4/120 + 4/200	6,200	151
3APS	31	4/120 + 20/200	18,300	154
3APS	31	2/120 + 4/200 + 4/220	21,300	158
3APS	62	5/150	13,400	115
4APS	31	5/150	13,400	154
4APS	31	4/120 + 4/200	10,900	180
4APS	31	4/120 + 20/200	10,400	185
4APS	31	2/120 + 4/200 + 4/220	11,600	181
4APS	62	5/150	7,000	135
3APS	15.5	4/120 + 20/200	21,900	166
4APS	15.5			

3APS and 4APS as curing agents

A more detailed study was made of the curing of Epon 828 by 3APS and 4APS and are summarized in Table II, below.

It may be seen that Epon 828 cured with 3APS has a higher heat distortion temperature than the same resin cured with 4APM. The flexural strengths are about the same. Curing with 4APS gives a plastic with a still higher heat distortion temperature, although the flexural strength is somewhat less. Note the effect of postcuring with 3APS.

Other Epon epoxy resins, such as 562, 834, 864, and 1001, were satisfactorily cured with 3APS. The results were similar to those obtained with Epon 828. Mixtures of 3APS with liquid aliphatic diamines were also used as curing agents. The 3APS is readily soluble in these amines; at room temperature, 100 parts of diethylenetriamine dissolves about 150 parts of 3APS, 100 parts of dimethylaminopropylamine dissolves about 88 parts, and 100 parts of diethylaminopropylamine about 25 parts. Epon 828 cured with saturated solutions of 3APS in these amines gave castings with flexural strengths in line with those given by 3APS alone.

Experimental procedures

Bis(3-aminophenyl)sulfone, m. p. 168° C., was prepared by reduction of bis(3-nitrophenyl)sul-

(*To page 228*)



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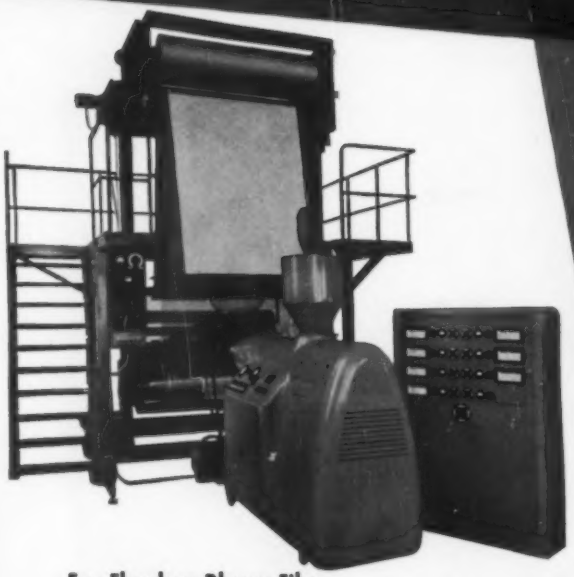
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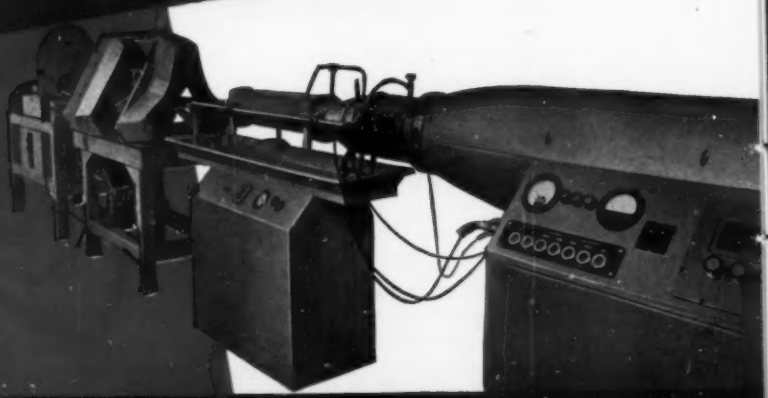


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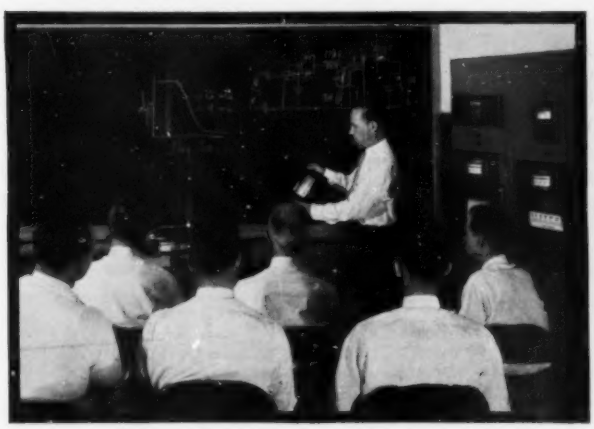


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Plastics Digest

Abstracts from the world's literature of interest to those who make or use plastics or plastics products. For complete articles, send requests direct to publishers. List of addresses is at the end of Plastics Digest.

General

Ionizing radiations. E. A. Burrill. Chem. Eng. *64,* 235-41 (Sept. 1957). The reasons for radiation processing, sources of radiation, energy and power, penetration, limitations, dosages, processing considerations, and economics of radiation are reviewed.

Materials

Fillers for PVC I. Phillips and P. G. Youde. Brit. Plastics *30,* 297-301 (July 1957). Filler is defined as "an inert inorganic material whose primary purpose is to reduce the raw material cost of the polyvinyl chloride compound." Basic requirements of a filler for polyvinyl chloride are: chemical inertness to polyvinyl chloride; capability of addition to the polyvinyl chloride composition without undue adverse effect on its physical properties; low solubility in water, oils, and common solvents; uniformity; and low volatility. A summary is given of the fillers in common use by the following usage classification: stabilizing, coloring, improving flame resistance, improving insulating properties, lowering the cost, and use in the flooring industry. Methods for assessing fillers in polyvinyl chloride pastes and other polyvinyl chloride compounds are presented. The effects of various fillers on the following physical properties are discussed: tensile strength, elongation, specific gravity, volume resistivity, water absorption, low temperature properties, softness, hot melt plasticity, resistance to indentation, and resistance to flame propagation.

Inorganic plastics. J. A. Brydson. Plastics (London) *22,* 384-5 (Sept. 1957). A literature survey was conducted for a variety of inorganic and organo-polymeric materials. Types of inorganic polymers discussed includes nitrogen-phosphorus, boron, sulfur, selenium, and silicon disulfide polymers. The organo-inorganic polymers include aliphatic and aromatic compounds of germanium, tin, lead, titanium, and vanadium. General reaction mechanisms are presented for most materials. Current and potential uses are described.

Composite fluorocarbon laminates for printed wiring. L. B. Allen, D. E. McElroy, and S. J. Stein. Elec. Manuf. *60,* 124-6 (Oct. 1957). New composite laminates, designed to overcome problems that arise from the conventional adhesive-bonded copper-clad laminate structures used in printed wire circuitry, are described. The new laminates are prepared by directly bonding copper foil to polymonochlorotrifluoroethylene and then bonding the fluorocarbon film to either phenolic or glass-epoxy backing by means of an adhesive. The resulting product, when etched, retains the high electrical properties of the fluorocarbon surface, especially superior arc resistance even under severe humidity.

Molding and fabricating

How to design cost out of plastic parts. R. L. Daggett. Product Eng. *28,* 77-79 (Oct. 14, 1957). Design features that tend to increase the cost of plastic items are described. A table of production processes for plastic parts lists various basic molding, casting, and laminating processes and gives the primary molding characteristics, principal materials, and advantages and disadvantages of each process. A second table lists forming processes to be specified for selected characteristics of the plastic product.

Applications

Plastics in building. Practical Builder *22,* 100-124 (Apr. 1957). A comprehensive survey of plastics products and materials now used by the building industry is presented. The qualities of these materials which serve better than the materials which they replace are stressed.

Vinyl flooring materials . . . how they are made . . . which one to use. C. W. Bulkley and A. J. Stockwell. Flooring *53,* 50-52 (Sept. 1957). Vinyl floorings may be divided into four main categories: calendered vinyl sheeting, homogenous or solid vinyl, vinyl-asbestos, and plastisol-coated vinyl. Methods of manufacture and advantages and disadvantages of each type are discussed.

Lined polyethylene bottles. J. H. Parliman and J. Pinsky. Modern Packaging *30,* 147-50, 208, 209 (July 1957). Polymeric linings have been developed that reduce the permeability of polyethylene bottles to numerous liquids. Data are presented comparing the permeability of unlined and lined bottles to various liquids.

57-foot plastic minesweeper. K. B. Spaulding. BuShips J. *6,* 2-4 (Sept. 1957). Details of the construction of the plastics minesweeper EX-MSB-23 are presented. This vessel has been in use since July 1956 and only minor defects or repairs have been reported to date.

Teflon-based piston rings for nonlubricated applications. R. D. Taber and F. A. Robbins. Mech. Eng. *79,* 838-41 (Sept. 1957). Several types of materials consisting of compounded Teflon, resin-bonded laminates, epoxy-bonded laminates and Teflon-bonded laminates were investigated for nonlubricated applications. The Teflon and glass-cloth laminate and the Teflon and glass-fiber molding exhibited excellent wear

(*To page* 165)

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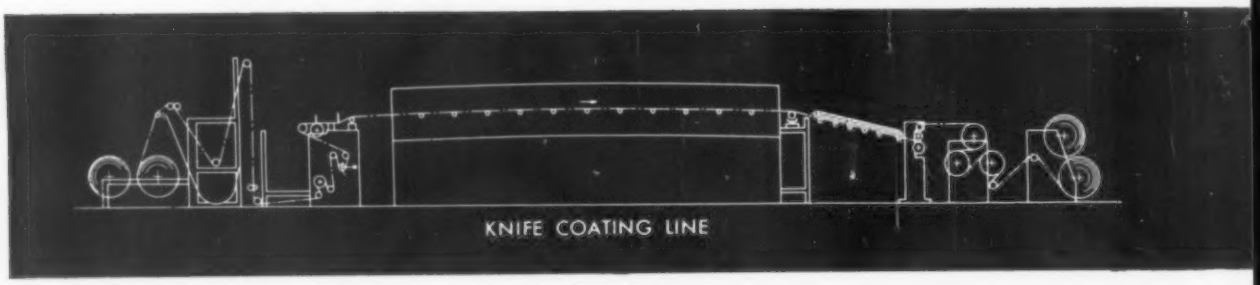
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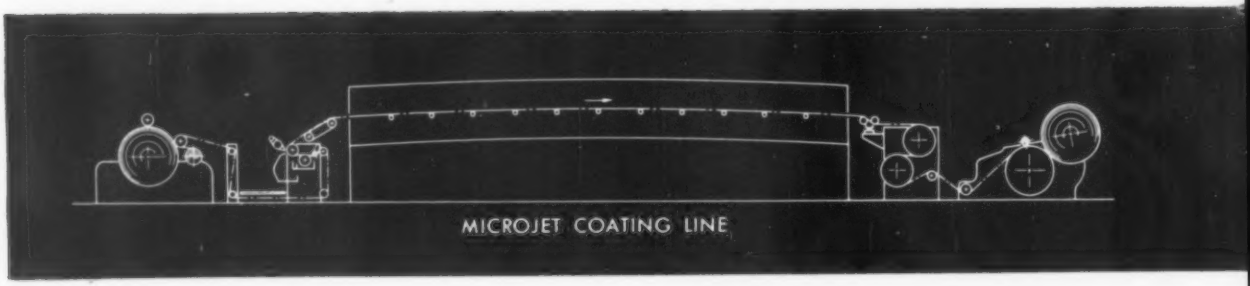
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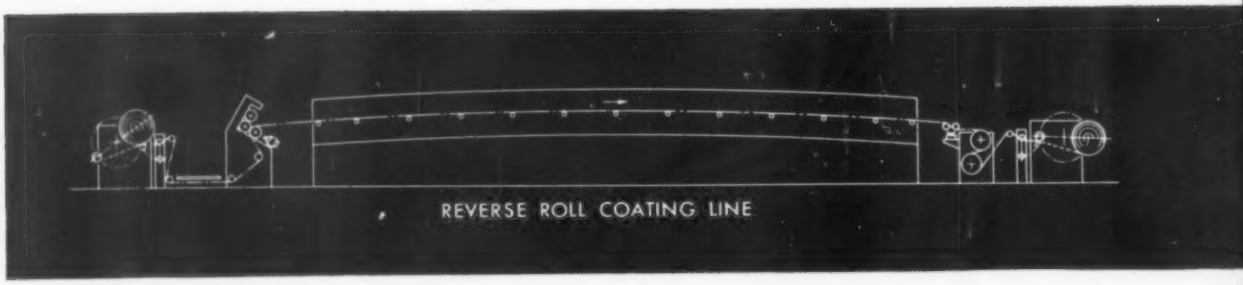
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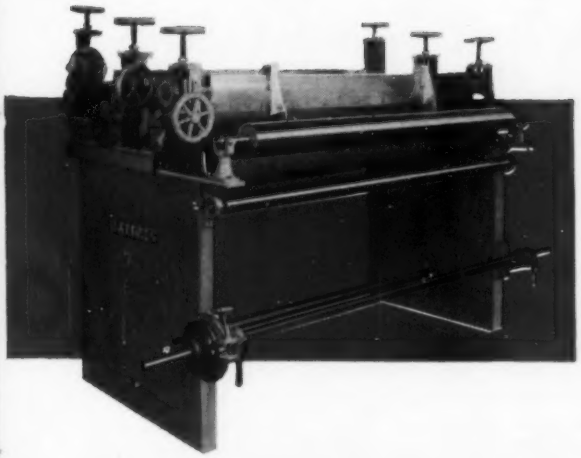
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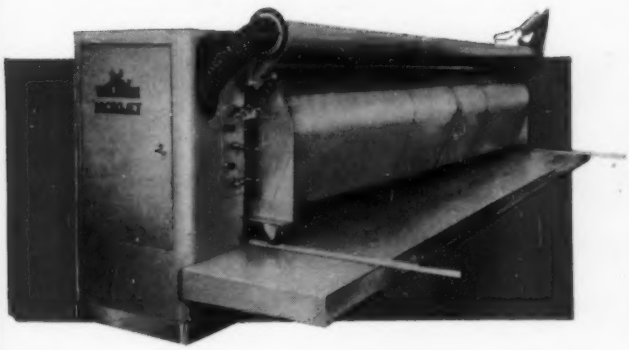
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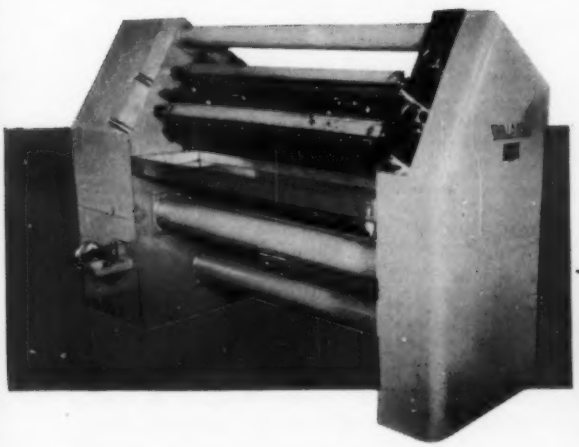


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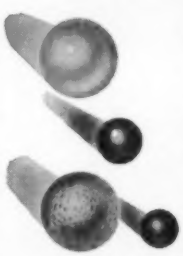
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resistance to a brake-shoe-loading wear-test machine. The Teflon materials also showed advantages in respect to chemical inertness, strength, and moisture resistance. Piston and wear rings made of a Teflon-glass fiber molding material were wear-tested under different conditions. The design of the rings and other applications of this material are described.

Plastic heat exchangers gain in severe service. D. M. Whitley. Chem. Eng. *64*, 308, 310, 312, 314, 316 (Sept. 1957). The use of plastics in heat exchangers when severe corrosive conditions must be met is described. The phenolics and furans, carbon- or asbestos-filled, are used for the majority of exchanger applications. Both resins have a safe range of use to 300° F. Glass-reinforced polyesters are used when higher pressures are encountered and are satisfactory for continuous use to 212° F. and for intermittent service to temperatures as high as 265° F. Steel lined with polyvinyl chloride is pressure resistant but only recommended for operation to 150° F. Design considerations and differences between the heat transfer of plastic and metal are discussed.

Characteristics of plastic scintillators. L. J. Basile. J. Chem. Phys. *27*, 801-04 (Sept. 1957). The light output of a group of organic solutes in polyvinyltoluene was obtained. The best plastic scintillator developed contained a combination of 2-phenyl-5-(4-biphenylyl)-1,3,4-oxadiazole (PBD) and 4,4′-diphenylstilbene. Fluorescence spectra were determined. If a secondary solute is added to the scintillator, the light emitted is primarily that of the secondary solute. Diphenyl mercury seriously quenches the light output in all cases tested.

Properties

Three-dimensional photoelasticity. M. M. Leven. Product Eng. *28*, 135-40 (July 1957). An evaluation is presented of the best model materials, simplest equipment, and most effective methods for practical three-dimensional photoelastic stress analysis of complex structures and parts. Highly stressed parts of unusual shape or loading, such as bolt threads, pressure vessels, shrink fits, and turbine disks running at high speed, often defy theoretical analysis. The "frozen stress" method of three-dimensional photoelastic analysis can determine precise stress distributions in all of these situations and in many others. In this method a plastic model is heated to a critical temperature, loaded, and then slowly cooled with the loads still acting. After cooling to room temperature, the loads are removed but the strains remain fixed or locked in the model. These strains represent an elastic distribution of stress, and careful cutting or slicing of the model will not disturb them. Slices are chosen with great care to give the desired information using light at normal incidence to the slice in a simple diffusion polariscope; these slices should be made along known principal planes of symmetry or free surfaces. The best materials available for three-dimensional frozen stress tests are the acid-cured epoxy resins.

Effect of change in temperature on the torsional energy losses in some polyamides. A. M. Thomas. Nature *179*, 862 (Apr. 27, 1957). The mechanical energy losses for polyamide fibers were determined by damping low-frequency torsional vibrations from 20 to 130°C. The maximum energy loss occurred at a high temperature in stretched fibers. Moisture lowered the temperature of maximum energy loss. The peak temperatures for the fibers were in the same order as the melting points.

Coloration of plastics by irradiation. S. H. Pinner and A. J. Swallow. Plastics (London) *22*, 194-95 (June) and 268-70 (July 1957). Several types of colored commercial plastics were irradiated in air for dosages up to 20 megarads, using a Van de Graaff accelerator. The specimens were examined for changes in color after periods of up to 6 mo. after irradiation. Some of the plastics showed changes in color after irradiation that were recoverable after standing or heating. Other plastics showed permanent changes in color while still others showed no change at all. Polyvinyl chloride plastics showed a transient change as well as a permanent one that was attributed to decomposition of the base material. Possible commercial applications based on permanent color changes as a result of radiation include patterning or decorative uses and printing, and also as an indicator of the uniformity of radiation.

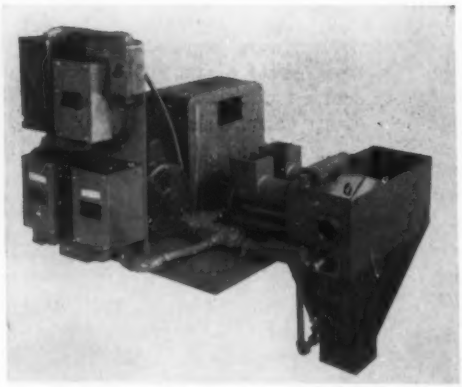
Water vapor diffusion through vinyl chloride-vinyl acetate copolymer. C. A. Kumins, C. J. Rolle, and J. Roteman. J. Phys. Chem. *61*, 1290-96 (Oct. 1957). The diffusion of water vapor through unplasticized and plasticized vinyl chloride-vinyl acetate copolymers was studied. Diffusion was Fickian and independent of concentration above and below the second-order transition temperature, in contrast to the behavior reported for organic vapors. For plasticized film the activation energy was 2.2 kcal./mole up to 60° C., after which it was 19.6 kcal./mole; for unplasticized film the activation energy was 7.7 kcal./mole up to 40° C. and 19.6 kcal./mole above that temperature.

Transfer of energy in solid plastic solutions. P. Avivi and A. Weinreb. J. Chem. Phys. *27*, 716-20 (Sept. 1957). The mechanism of energy transfer in plastic phosphors was investigated. Energy transfer efficiencies in polystyrene and styrene solutions are compared. Energy transfer as an intramolecular process is discussed and shown not to be an essential condition for high-energy transfer efficiency in plastic solutions. Experimental data furnish strong evidence for energy transfer by intermolecular processes as in liquid solutions.

Testing

Testing poly-cello pouches. I. Olsson and L. Pihl. Modern Packaging *30*, 157-58, 160 (June 1957). A new technique and instrument are described that were used in evaluating vacuum and liquid-holding packages made of polyethylene-coated cellophane. A pouch is inflated with air and

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the pressures required to cause failure in a weld and in unwelded material are determined. By this method the sealing properties of different materials as well as their strength can be compared.

Electronic pendulum for evaluating impact absorption of foam materials. C. S. Wilkinson, Jr. Rubber World *136*, 841-6, 851 (Sept. 1957). An impact pendulum machine has been designed for evaluation of foam materials. Mechanical and electrical features of the apparatus are presented in detail. Design formulae and velocity and energy equations are derived. Data are obtained by means of photographs of an oscilloscope record of acceleration and deceleration of the pendulum after impact. The oscilloscope traces are used to calculate kinetic energy of the pendulum at impact and rebound, and to plot impact hysteresis loops of deceleration vs. penetration. Damping characteristics, peak deceleration values, and pendulum velocities are also obtained from the photographic records. Data are presented for maximum deceleration and penetration, damping effect, and absorbed energy for a number of open and closed cell polyurethane and vinyl chloride resin foams of various densities, using impact velocities ranging from 64 to 222 in. sec.

Resin identification in textiles. Texture *4*, 107-09 (Sept. 1957). Details of two rapid, simple tests which may be used to identify seven resins commonly used as textile finishes are presented.

Photothermoelasticity: an exploratory study. G. Gerard and A. C. Gilbert. J. Appl. Mech. *24*, 355-60 (Sept. 1957). An explanatory study was made to determine the merits of photothermoelastic techniques in the verification of thermal-stress analyses. Optical and physical properties, pertinent to analysis of thermal stresses, of a photoelastic model material. Paraplex P-43, were obtained over a temperature range of —40° to 70° F. Disks and long-beam models were used, respectively, as representatives of

interference and thermal-gradient type thermal-stress fields. Techniques and equipment used to determine the modulus of elasticity, the material fringe value, and the thermal-expansion coefficient are described. Investigations were conducted into the plane-stress problems of a disk contracting on an elastic inclusion, and of the thermal-stress field produced by a temperature differential applied suddenly to the upper edge of both long and short beam models. Time-dependent behavior of complete thermal-stress fields were observed and recorded photographically.

Chemistry

Interaction of polyvinylpyrrolidone with some azo dyes. H. P. Frank, S. Barkin, and F. R. Eirich. J. Phys. Chem. *61*, 1375-80 (Oct. 1957). Polyvinylpyrrolidone shows strong binding affinities for various organic anions such as the azo dyes—orange II and benzopurpurin 4B. It was found that the dyestuff ion is bound by chain segments of 7 to 10 monomer units, probably with the long axis alongside the polymer chain, held by van der Waal's forces.

Publishers' addresses

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Journal of Physical Chemistry: American Chemical Society, 1155 Sixteenth St., N. W. Washington 6, D. C.

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Modern Packaging: Modern Packaging Corp., 575 Madison Ave., New York 22, N. Y.

Nature: Macmillan and Co., Ltd., St. Martin's St., London W. C. 2, England.

Petroleum Refiner: Gulf Publishing Co., Box 2608, Houston 1, Texas.

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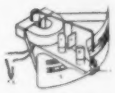
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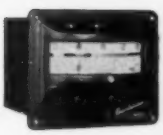


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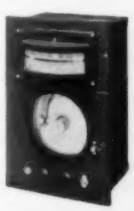


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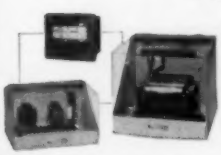
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Polyamides. Y. Hachihama, and I. Hayashi. U. S. 2,808,392, Oct. 1. Polyamides having a furan nucleus.

Terpolymer. A. F. Harris (to Monsanto). U. S. 2,808,393, Oct. 1. Terpolymer of vinyl acetate, maleic anhydride, and a beta-alkoxy ethyl partial ester of maleic acid.

Polysulfonamides. S. B. Speck (to Du Pont). U. S. 2,808,394, Oct. 1. Polysulfonamides.

Polymers. H. M. Hill (to Eastman Kodak). U. S. 2,808,395-6, Oct. 1. Alkyl alpha-alkyl-sulfonyl-acrylate polymers.

Polymers. R. Stroh and J. Ebersberger (to Bayer). U. S. 2,808,397, Oct. 1. Resinous hydroxy-ether amides of polyacrylic acids.

Molding. V. Terracini and G. Tedeschi. U. S. 2,808,617, Oct. 8. Molding lengthy articles from multicolored plastic.

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Cellulose esters. A. W. Sloan and D. J. Mann (to Atlantic Research). U. S. 2,809,191-2-3, Oct. 8. Spherical particles of cellulose esters.

Molding. W. G. Harvey. U. S. 2,809,394, Oct. 15. Automatic discharge for molding machine.

Shelter. M. G. Druck (to Plastimayd). U. S. 2,809,649, Oct. 15. Plastic shelter.

Cellulose derivatives. J. D. Brandner (to Atlas Powder). U. S. 2,809,899, Oct. 15. Plasticized cellulose derivatives.

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Laminating. H. M. Richardson (to Atlas Powder). U. S. 2,809,911, Oct. 15. Laminated products.

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Resins. H. G. Cooke, Jr. (to Devoe & Raynolds). U. S. 2,809,942, Oct. 15. Polyglycidyl cyanurates.

Resins. D. J. Pye, J. J. West, P. M. Craven, and J. A. Patterson (to Dow Chemical). U. S. 2,809,943, Oct. 15. Weighted ion-exchange resins.

Resin. J. Dazzi (to Monsanto). U. S. 2,809,947, Oct. 15. Plasticized polyvinyl chloride.

Polyesters. A. A. Varela (to American Cyanamid). U. S. 2,809,951, Oct. 15. Polyester-benzoguanamine-formaldehyde composition.

Resin. J. Werner, R. Steckler, and F. A. Hessel (to General Aniline). U. S. 2,809,953, Oct. 15. Modified phenolic resin.

Resin. Z. Kazenas (to Switzer Bros.). U. S. 2,809,954, Oct. 15. Melamine - sulfonamide - formaldehyde compositions.

Resins. L. A. Matheson and R. F. Boyer (to Dow). U. S. 2,809,955, Oct. 15. Stabilizing alkenyl aromatic resins.

Polymers. G. P. Mack and E. Parker (to Carlisle Chemical). U. S. 2,809,956, Oct. 15. Polymeric organotin mercapto stabilizers for halogen resins.

Resins. A. J. Buselli (to Air Reduction). U. S. 2,809,957, Oct. 15. Polyurethane resins.

Polymerization. C. E. Barnes, W. O. Ney, Jr., and W. R. Nummy (to General Aniline). U. S. 2,809,958, Oct. 15. Polymerization of 2-pyrrolidone.

Resins. H. H. Roth (to Dow). U. S. 2,809,959-60, Oct. 15. High-viscosity resin sulfonates.

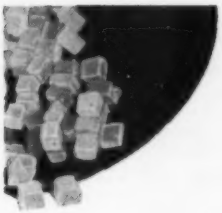
Extrusion. H. Teichman (to Kraus-Maffei). U. S. 2,810,159, Oct. 22. Extrusion press.

Molds. R. Bottleman (to Great American Plastics). U. S. 2,810,160, Oct. 22. Molds for plastic blowing machines.

Laminating. M. O. Longstreth and G. J. Ward (to Dow). U. S. 2,810,423, Oct. 22. Laminating thermoplastic film.

Tubing. E. E. Swartswelter and G. V. Jullgren (to Aetna-Standard). U. S. 2,810,424, Oct. 22. Reinforced plastic tubing.

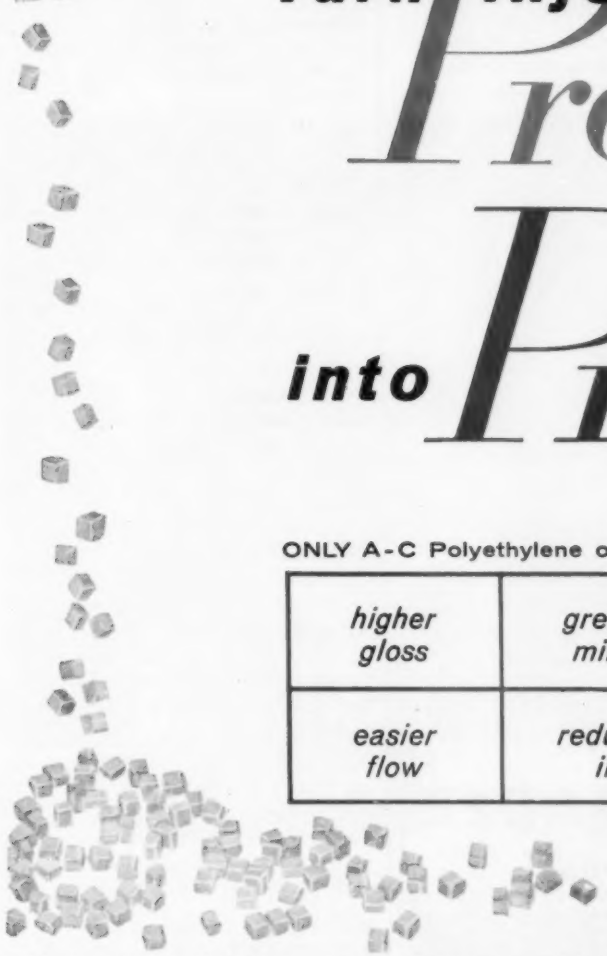
Cellulose ethers. G. K. Greminger, Jr. and M. A. Weaver (to Dow).



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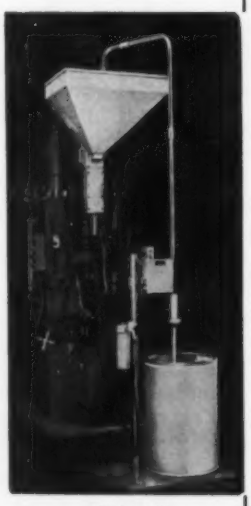
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U. S. 2,810,659, Oct. 22. Cellulose ethers.

Laminates. J. V. Madden (to Hughes Aircraft). U. S. 2,810,674, Oct. 22. Resin laminates.

Resins. L. F. Bornstein. U. S. 2,810,-700, Oct. 22. Amine-aldehyde resins.

Dispersions. M. F. Bechtold and M. I. Bro (to Du Pont). U. S. 2,810,-702, Oct. 22. Polyvinyl fluoride dispersions.

Resins. K. W. Krantz (to General Electric). U. S. 2,810,704-5, Oct. 22. Methyl methoxypolysiloxane.

Resins. C. Frazier and L. E. Caldwell (to American Cyanamid). U. S. 2,810,706, Oct. 22. Oxirane triazine resins.

Molding compositions. F. B. Nagle (to Dow). U. S. 2,810,707, Oct. 22. Molding compositions of alkenyl aromatic resins.

Stabilizers. M. A. Kubico, R. N. MacDonald, R. L. Stearns, and F. A. Wolff (to Du Pont). U. S. 2,810,708, Oct. 22. Stabilizing formaldehyde with hydrazine polymers.

Resins. H. Holtschmidt (to Farbenfabriken Bayer). U. S. 2,810,711, Oct. 22. Polymeric isocyanates.

Resins. C. F. Baranauckas (to Hooker). U. S. 2,810,712, Oct. 22. Polymers of unsaturated esters of poly-halogen-containing dicarboxylic acids.

Polymerization. E. F. Jordan, Jr. (to United States). U. S. 2,810,715, Oct. 22. Vinylidene chloride and alkyl acrylate copolymerization.

Bottles. J. Bailey (to Plax). U. S. 2,810,934, Oct. 29. Plastic bottles.

Molding. O. A. Braley (to Dow). U. S. 2,811,408, Oct. 29. Organosilicon mold parting agent.

Films. H. Wittcoff and W. A. Jordan (to General Mills). U. S. 2,811,459, Oct. 29. Polyamide films.

Plastics. L. W. A. Meyer and M. H. Broyles (to Eastman Kodak). U. S. 2,811,460-1, Oct. 29. Cellulose ester plastics.

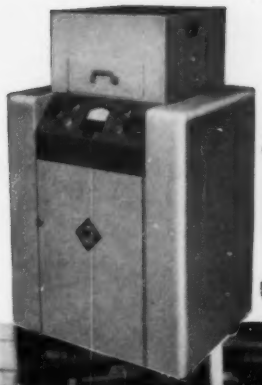
Film. S. P. Joffre (to Shulton). U. S. 2,811,468, Oct. 29. Impermeable polyethylene film.

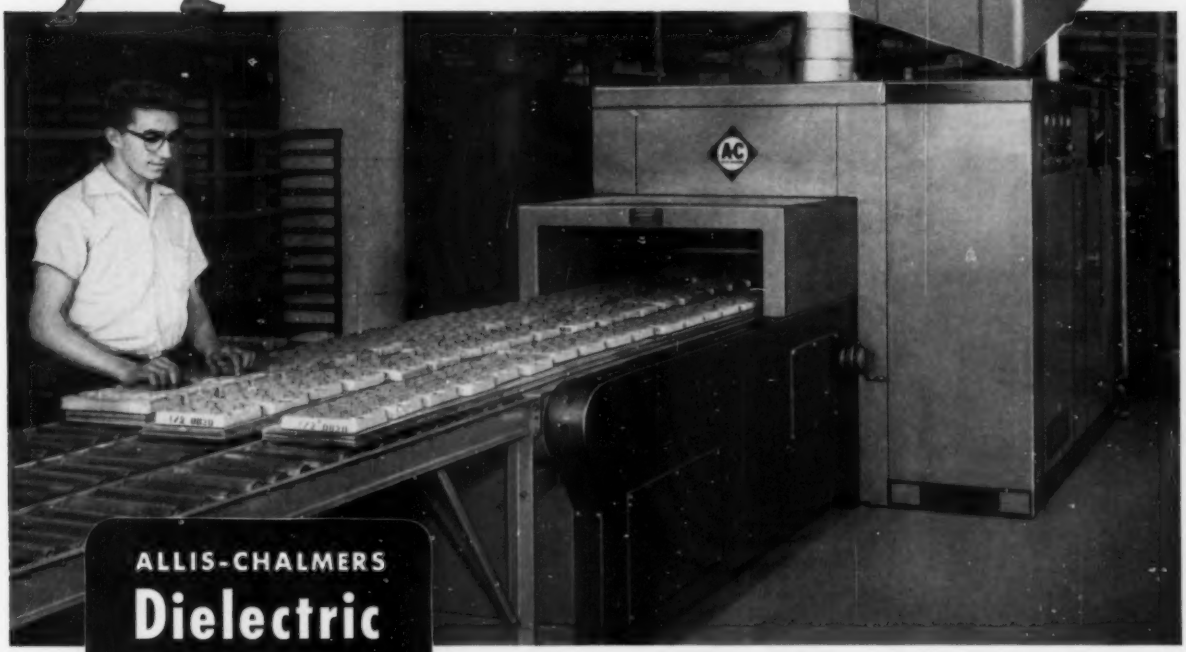
Resins. E. Simon and F. W. Thomas (to Lockheed). U. S. 2,811,493, Oct. 29. Alkyd resin-diisocyanate composition.

Resins. H. Wittcoff and M. M. Renfrew (to General Mills). U. S. 2,811,-495, Oct. 29. Suspensoids of epoxy and polyamide resins.



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New Machinery and Equipment*

Offset printer

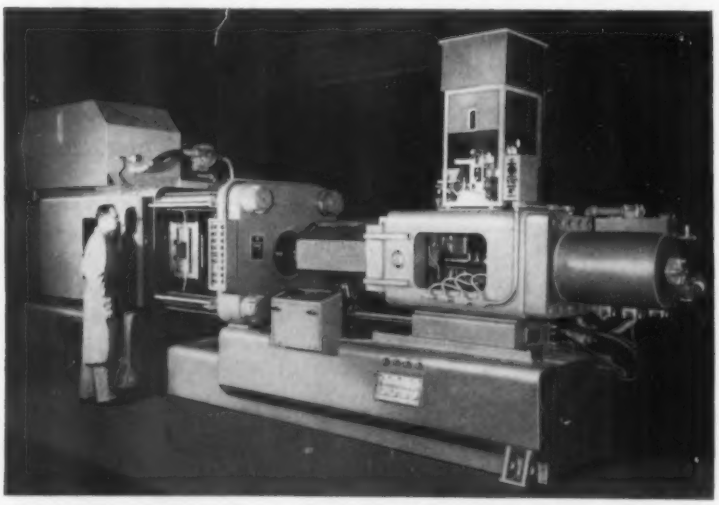
The Matthews No. 248 Offset Printer is designed to provide continuous lineal printing on bars, tubing, or similar products. Mounted directly over a moving production line, the unit is capable of printing on an unlimited range of product sizes from ½-in. O.D. up. The printer is capable of continuous printing speeds as high as 50,000 ft. of material per 8-hr. day. *Jas. H. Matthews & Co., 3951 Forbes St., Pittsburgh 13, Pa.*

Fast injection machine

A 32/42 oz. addition to the HPM injection molding machine line is claimed to be the fastest machine of its size on the market today. The 650-ton unit, with a total of 107½ hp., features an injection rate of 2510 cu. in./min., over 300 cycles/hr., a mold mounting area of 30 by 48 in., and a full hydraulic clamp with 30 in. stroke, 50 in. daylight. Clamp controls are centralized, and easily adjusted limit switches provide variable stroke, variable daylight, slow close for die contact, slow break-away, and slow injection stroke. Independent clamp and injection circuits allow simultaneous traversing of both clamp and injection rams. This feature eliminates dead time inherent in machines using a single circuit with a diverting system. The new machine incorporates a compensating-type, automatic weigh feeder as standard equipment. The plasticating chamber, 300 lb./hr. capacity, is equipped with three heat zones, each pyrometer-controlled. Heating bands are mounted directly on the spreader. *The Hydraulic Press Mfg. Co., a Div. of Koehring Co., Mt. Gilead, Ohio.*

Pellet mill

A laboratory pellet mill makes it possible to reproduce the end results to be anticipated from high production powder pelletizers. With the aid of a laboratory mill, researchers are able to reliably decide the usefulness of production pelleters on the basis of small-scale studies. The mill is designed to take into account those factors which cannot be scaled down by a direct mathematical process. The machine can be hand-fed, or equipped with any number of mechanical feeding devices. It can also be equipped with a spray nozzle for applying liquids or vapors on the die surface. *Sprout, Waldron & Co., Inc., 130 Logan St., Muncy, Pa.*



H-P-M 32/42-oz. injection molding machine has injection rate of 2510 cu. in./min.; more than 300 cycles per hour

Speed control valve

A new hydraulic speed control valve rated for 1000 p.s.i. hydraulic operation is made in the ¼-, ⅜-, ½-, and ¾-in. sizes. The valve is used to control the piston speeds of hydraulic cylinders and the speeds of other hydraulically operated devices. When used with cylinders, the valve allows the instroke and outstroke speeds to be regulated separately. Flow can be controlled from zero to desired capacity with only one revolution of the calibrated adjusting sleeve. *Hanna Engineering Works, 1765 Elston Ave., Chicago 22, Ill.*

Foaming machine subdivided into modular units

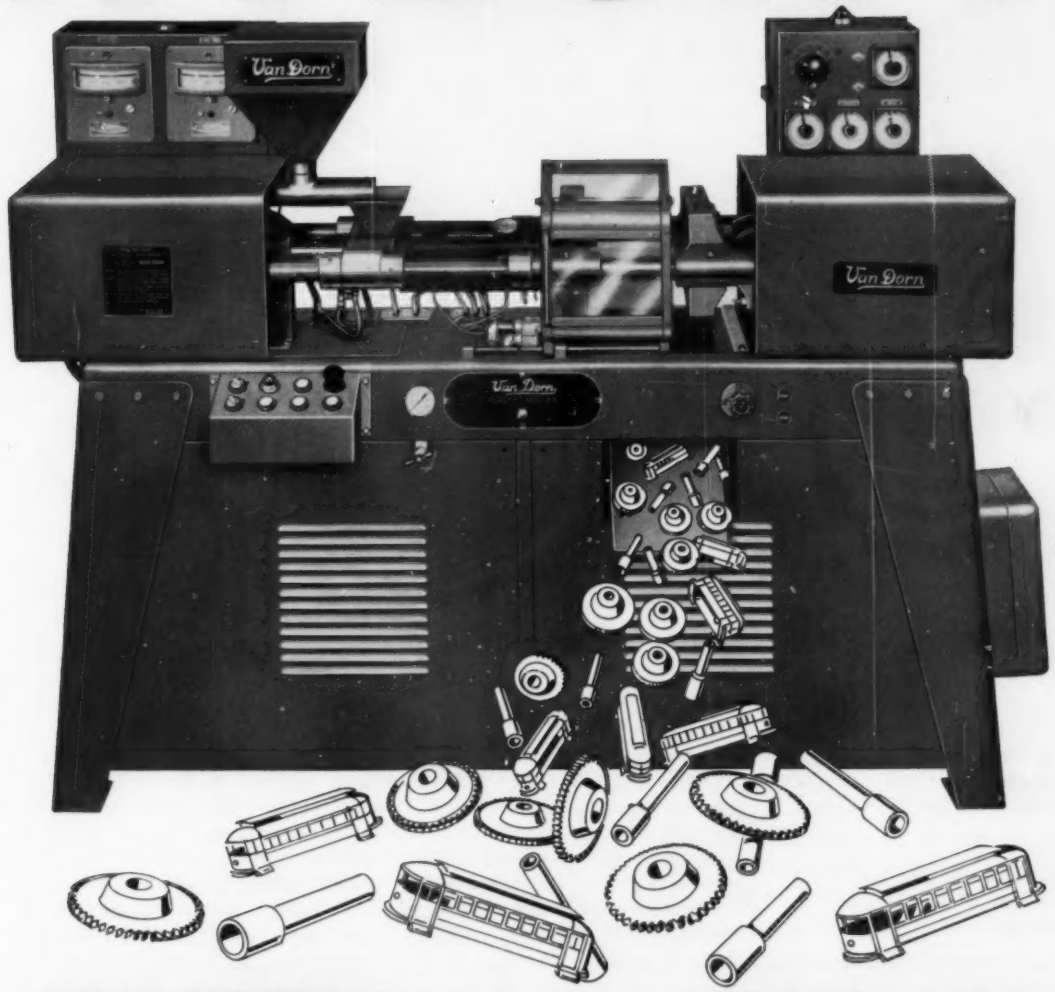
The resin-blending machine described in MODERN PLASTICS *34*, 162 (July, 1957) p. 162, has been packaged in modular subunits. The resin pumping section, the catalyst pumping section, and the mixing section are all available separately in metal cabinets with appropriate control instruments grouped at the top of each cabinet. *The Martin Sweets Co., 114 S. First St., Louisville 2, Ky.*

Rotary press

The Cropp rotary compression molding press, for automatic molding of small articles such as closures, electrical parts, and other large quantity items, is now available in a 20-station model with 8 tons pressure per station. For several years, Cropp Engineering Div. of El-Tronics, Inc. has been producing a 20-station

*Specifications and claims made and appearing in these pages are those of the manufacturers of the machinery and equipment described and are not guaranteed by MODERN PLASTICS.

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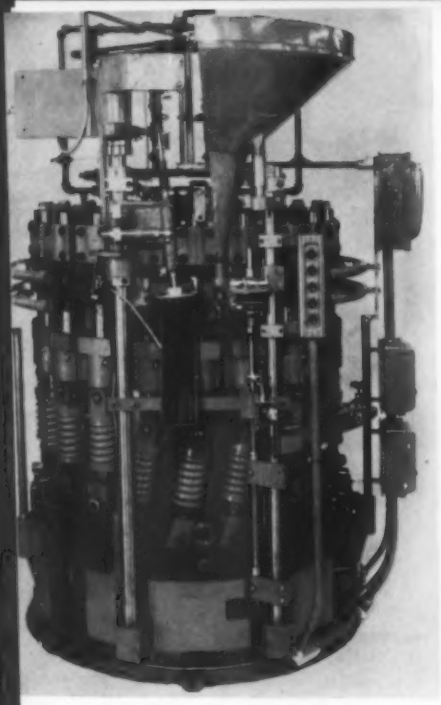
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Cropp rotary compression press with 20 stations, 8 tons pressure per station

3½ ton press. The new hydraulic units are designed for molding larger articles and deeper draws. Rotary molding is generally considered only where the number of parts required is in excess of one million. *The Rainville Co., Inc., 224 Seventh St., Garden City, N.Y.*

Replacement knives for granulators, slitters, fly-knife cutters

A line of hardened steel knives for chippers, slitters, and granulators is now available for all types of cutting machines. The "OK" knives are made from special high-speed steel hardened all the way through. They are said to be so hard and tough that they will hold a keen edge under the most adverse conditions. They will be ground to tolerances of ±0.1 mil if desired. *Ohio Knife Co., 1748 Dreman Ave., Cincinnati 23, Ohio.*

Screw-in inserts

"Inserto U-tap" is the name of a new line of inserts that provide steel threads in softer materials. Insertos are threaded inside and out and the inside thread is broached lengthwise to accommodate a hex-bar that resembles one end of an Allen wrench. The soft material is tapped (or molded with threads) to the outside thread of the insert, then the insert is driven home (by hand or power tool) with the hex-bar wrench. An internal thread-locking feature is optional. External locking threads lock insert into parent material. Available in "several" sizes, these inserts are case hardened. *Rosán, Inc., 2901 West Coast Highway, Newport Beach, Calif.*

Portable surface pyrometer

The Model 1331 surface pyrometer, with an assortment of quick-disconnect sensitive elements, can be used to measure temperatures of molds, cylinders, melts, etc., up to 1500° F. (in highest scale range). Swivel head makes it easy to measure temperatures at odd angles. Pick-up arm is rigid, but an auxiliary cable is an optional extra. Standard unit includes instrument, case, ambient-temperature thermometer, any one pick-up element. *Pyrometer Service Co., 348 River Rd., North Arlington, N. J.*

Hydraulic presses

A new line of presses, ranging in capacity from 30 to 500 tons, is claimed to feature great strength and trouble-free serviceability. These presses may be had either bare or engineered and equipped to customer's specifications. *Kohler-Joa Corp., Sheboygan Falls, Wis.*

Heat guns

Useful in plastics fabrication and for spot-drying and heat-curing, these heat guns are available in eight models of different wattage and air capacity, resulting in different temperature ranges. Top temperature is about 1000° F., maximum air volume is 35 cu. ft./min. at a velocity of 50 ft./sec. All four models are available for either 115- or 220-v. lines. *Master Appliance Mfg. Co., 532 Fourth St., Racine, Wis.*

Polyurethane foamer

A compact foam mixer meters and mixes catalyst and resin for urethane foam. It has a cycle-timed on-off feature that facilitates making foam moldings. Standard metering system handles resin flow rates of 2 to 12 lb./min. Plug valve that directs flow of materials is made of self-lubricating TFE resin. *Isocyanate Products, Inc., Wilmington 99, Del.*

High-speed flexographic press

These web-fed presses are available in units for one to six colors with hot-air drying systems. Available widths are 15, 22, 27, and 30 in., and the along-the-web printed length is variable from 6.3 to 35 inches. Drying is accomplished by thermostatically controlled, infra-red-heated air with forced circulation. Other features: forward and side adjustments on unwind stand, brake tension control, two ink fountain rollers for each color, splashproof fountains, and others. Over-all dimensions are 53 in. wide by 70 in. long by 80 in. high. *Lee Machinery Corp., 28 W. 23rd St., New York 10, N. Y.*

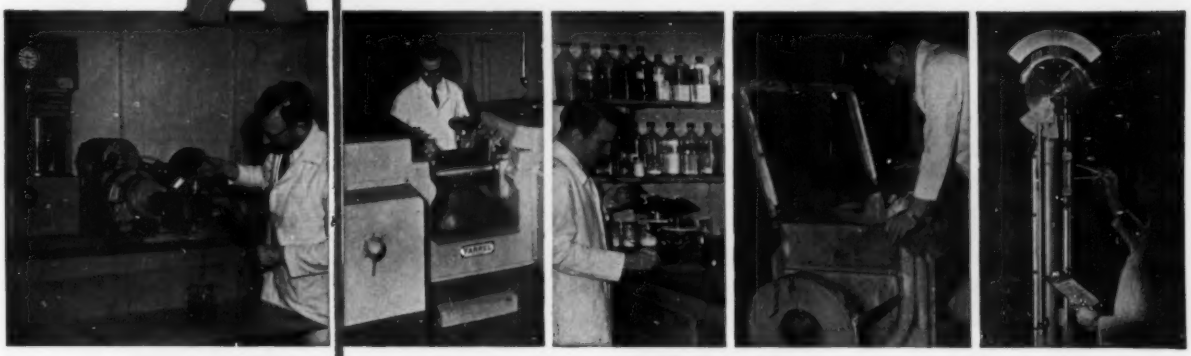
Automated hot stamper for second-surface work

A multi-station hot-stamping machine has been designed especially for second-surface decoration of transparent plastics. Productivity and reject rates are both claimed to be better than with spray-painting of such surfaces, and of course no masks are needed. Stamping force developed depends on job, as do many other design features of unit, but can range from 20 lb. to 4 tons on airpowered units, up to 15 tons on hydraulic units. Rates up to 50 impressions per minute have been achieved. *Weber Hot Stamping Equipment Co., 3253 N. Kedzie Ave., Chicago 18, Ill.*

Induction-heated extruders

Induction-heated extruders in a newly offered line are said to provide savings in operating costs, faster response, faster warm-up, and a better balance between heat of the extruder and heat of the plastic being processed. The induction heating system causes the necessary extruder operating temperature to originate directly in the cylinder walls, whence it is absorbed by the plastic in the cylinder. In conjunction with the induction-heating, a system of

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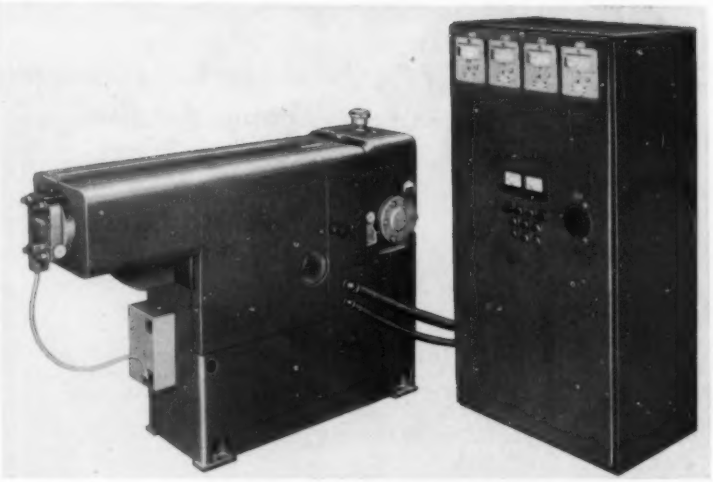
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balanced heat control improves temperature control and precision of extrusion. Cost savings are possible because less energy is wasted in heating cylinders by the induction principle. The induction-heated extruder is to be available in the standard range of sizes, to meet all extrusion requirements. *National Rubber Machinery Co., 47 W. Exchange St., Akron 8, Ohio.*

Long-lived finishing tools

A circular saw blade that cuts plastics without chipping, crazing, or melting them is one of a new line of cutting and grinding tools that are based on tungsten carbide grits brazed to a steel surface. Sheets, rods, sleeves, files, "sanding" disks, etc., can all be fashioned of this stuff, which lasts almost indefinitely. Tools are available in nine grits, from No. 24 coarse to No. 220 very fine. *Skil Corp., 5033 Elston Ave., Chicago 30, Ill.*

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A whole postforming "package" including machine, glue jig, and panel saw, enables fabricators of melamine laminates to set up an entire postforming operation quickly and at moderate cost. While the machine is geared for high production, it is expected to have particular appeal to the small-to-medium-sized fabricator. The machine is designed for either one- or two-man operation and all three normal countertop bends can be made on the one machine with no changes in tooling. Less than 14 min. are required to make these three bends and the machine will produce four to six tops an hour in normal operation. *Panelyte Div., St. Regis Paper Co., East Providence, R.I.*

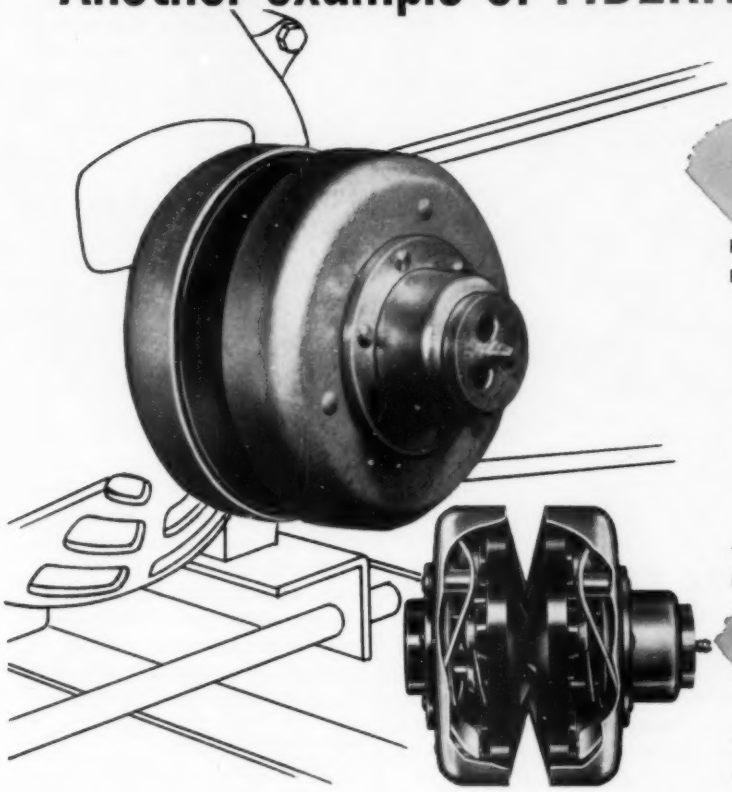
Threaded inserts

The H-series Tap-Lok inserts are intended to be screwed into a hole in a parent material, cutting their own threads as they go. Special features are: 1) balanced thread-cutting action, 2) truncated external thread roots for greater strength, and 3) full-length inside threads meeting Class 2B or 3B specs. They are available in three standard lengths in cadmium-plated or stainless steel. *Groov-Pin Corp., 1125 Hendricks Causeway, Ridgefield, N. J.*

Radiant heaters

A line of tubular infra-red radiant heaters for use in ambient temperatures up to 1000° F. can be used for baking, curing, drying, dehydration, degreasing, preheating, vulcanizing, and other industrial applications requiring controlled, economical heat. The line is available in both panels and individual tubular elements. The units come in both 120 and 240 v. but can be wired in series for use with 480 v. if desired. The line ranges in size from 11 to 48 in., in wattage from 500 w. up to 36-kw panels. The standard

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wavelength is said to be suitable for most applications, but the company also makes the units in special or modified wave lengths to meet special requirements. *Douglas C. Whitaker Co., Inc., 141 E. Glenside Ave., Glenside, Pa.*

Die handling table

A die handling table will roll and turn, lift and lower, and push and pull loads up to 2500 pounds. The rugged table will also transport such loads and slide them to another surface without manual strain or risk of damage to either load or man. The top-plate of the new table has an area of 748 sq. in. (22 by 34) and is fitted with eight recessed, free-rolling conveyor rollers for ease in moving loads. A ram, impelled by a screw and nut device, travels the length of the top plate, pushing loads from table to press or storage shelf, and pulling loads from press or storage shelf to table. *The Hamilton Tool Co., 9th St. at Hanover, Hamilton, Ohio.*

Anti-static buffer

A new high-color buffing compound for scratch-free finishing of all plastics contains an ingredient said to impart antistatic properties to the part being finished. The new compound, PC-93, is specifically formulated for high-color buffing of thermoplastic materials. It is a relatively dry compound containing a soft abrasive for high-color finishing without scratching. A built-in lubricant eliminates problems of roll-over or burning, particularly when softer plastics are involved. The anti-static property of the new compound will eliminate a processing step at many installations. *Hanson-Van Winkle-Munning Co., Matawan, N.J.*

Diamond-coated saws

Specifically engineered for cutting all types of reinforced plastics, a new line of diamond-coated saws is available in over 100 types, both mounted and unmounted, in diameters up to 24 inches. Among these types are routing tools and hole saws, the latter in diameters from ¾ to 6 inches. *O'Rourke Diamond Co., Inc., 11423 Van Owen St., North Hollywood, Calif.*



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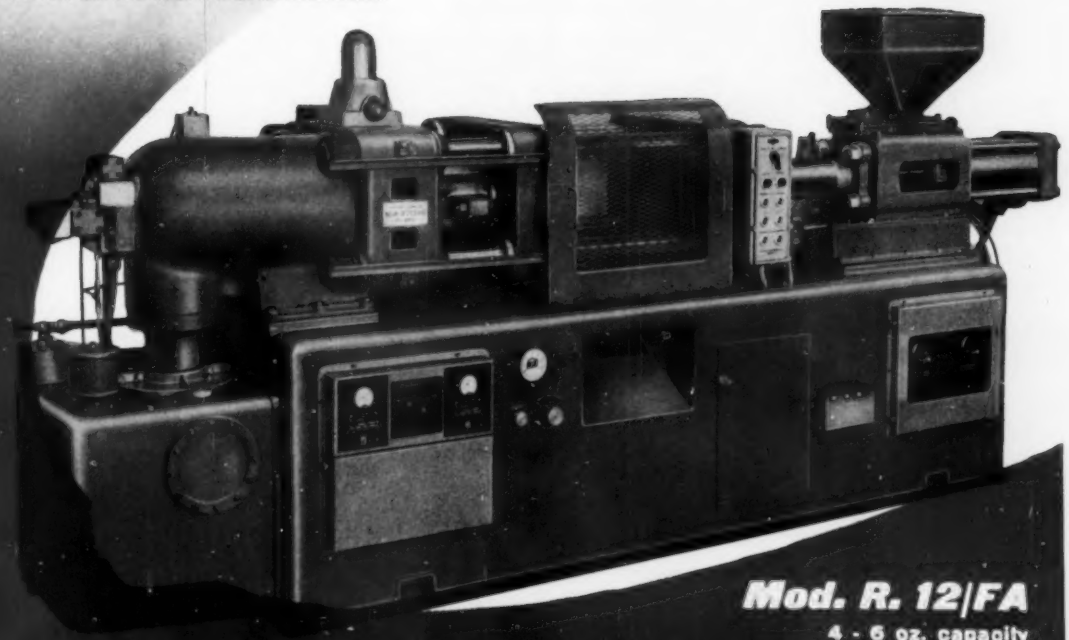
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Books & Booklets

Write for these publications to the companies listed. Unless otherwise specified, they will be sent gratis to executives who request them on business stationery.

"Cope's Plastics Book"

By Dwight Cope. Edited by Floyd Dickey

Published in 1957 by The Goodheart-Willcox Co., Inc., 1322 S. Wabash Ave., Chicago 5, Ill. 272 pages. Price: $4.50.

Here is an interesting description in words and pictures of how to make more than 90 colorful craft projects—ranging from elementary to advanced, and suitable for both school and home workshop use—from the many different plastics materials. Among the subjects dealt with are storing, sawing, machining, polishing, heat forming, cementing and bonding, and cleaning. There are also sections on internal carving and dyeing and on commercial fabrication methods. A glossary is included.

Plasticizers. Descriptions, specifications, typical properties, and prices are given for the Truflex line of plasticizers. 24 pages. *Thompson Chemical Co., 90 Mendon Ave., Pawtucket, R.I.*

Teflon. How industry can rely on Chempac Teflon and Chempac asbestos-Teflon packings and gaskets to withstand practically all chemicals and solvents. 16 pages. *Johns-Manville Corp., 22 E. 40th St., New York 16, N.Y.*

"Tenite Plastics Views" describes how plastics are color-matched to other materials by a method that has developed more than 38,000 plastics color formulations. 20 pages. *Eastman Chemical Products, Inc., 260 Madison Ave., New York 16, N.Y.*

Plate magnets. Comparative performance charts and graphs showing how to select the exact type and size of plate magnet needed for tramp iron separation, and complete specifications on a new line of Magman plate magnets. Bulletin 1071. 8 pages. *Stearns Magnetic Products, 635 S. 28th St., Milwaukee 46, Wis.*

Color chart. Sample chips of colorants, including pearl colors, made in concentrated paste form for easy incorporation into liquid acrylic resins for casting or coating. Price list is included. 6 pages. *Plastics Color Co., 22 Commerce St., Chatham, N.J.*

"Resins for the Rubber Industry." Resins for rubber compounding and for adhesives—general, technical, and product data; applications charts; and ordering instructions. 29 pages. *Schenectady Resins Div., Schenectady Varnish Co., Inc., Schenectady 1, N.Y.*

Vinyl plastisol. How plastisol viscosities are affected by compounding with various types and concentrations of fillers, plasticizers, pigments, stabilizers, surfactants, and diluents; and how Opalon 410, a stir-in type vinyl resin, may be used for formulating all plastisols discussed. Bulletin 1034. 28 pages. *Plastics Div., Monsanto Chemical Co., Springfield, Mass.*

"Progress Report Four" gives detailed summaries and tables covering the company's findings in an "every climate" test program on acrylic emulsion paints. 56 pages. *Rohm & Haas Co., Washington Sq., Philadelphia 5, Pa.*

Spray booths. Descriptions and specifications for spray booths of every type, size, and application, ranging from custom to "ready made" units which can be erected using only a wrench and screwdriver. Catalog I-7000. 37 pages. *The DeVilbiss Co., 296 Phillips Ave., Toledo 1, Ohio.*

Industrial air specialties. Air blow, safety chip, spray, and cleaning guns; air hose couplings, stems, and clamps; and two-way blow valves, air spray nozzles, oil mist lubricators, swivel connectors, and bobbin blowers are among the products described in Catalog 6. 12 pages. *C. A. Claflin Co., 15 Hathaway St., Boston 10, Mass.*

High-impact thermoplastic. Ten reasons why Cycolac, a uniform, high-impact thermoplastic, offers an opportunity for development of new products. 16 pages. *Marbon Chemical Div. of Borg-Warner, W. 10th and Garfield, Gary, Ind.*

Secondary vinyl plasticizer. Technical data and advantages of Kenplast, a light-colored petroleum product useful as a plasticizer for vinyl resins. 2 pages. *Kenrich Corp., 57-02 48th St., Maspeth 78, N.Y.*

Powdered acid. Properties, uses, recommended solution concentrations, and application methods of Drycid, a recently introduced powdered acid scale and rust remover. 2 pages. *Oakite Products, Inc., 146D Rector St., New York 6, N.Y.*

"Peracetic Acid and Derivatives" includes a treatise on the synthesis of peracetic acid and epoxides, reactions of epoxides, and an extensive bibliography. Bulletin F-40,108. 48 pages. *Union Carbide Chemicals Co., 30 E. 42nd St., New York 17, N.Y.*

Chemical intermediates. Line of chemical intermediates for the dyestuff, pigment, and pharmaceutical industries, as well as isocyanates for foam, adhesive, resin, elastomer, and other end uses. 28 pages. *The Carwin Co., North Haven, Conn.*

Urethane modification. Advantages of more than 20 derivatives of castor oil that are currently or potentially useful in such appli-

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cations as rigid and flexible foams, elastomers, coatings, and adhesives. "Castor Oil Products for Urethane Polymers," technical bulletin 31. 24 pages. *The Baker Castor Oil Co., 40 Avenue A, Bayonne, N.J.*

Custom casting process. Description of Accu-Cast, a licensed adaptation of the Shaw Process, which is now available for the first time to injection and compression molders for quick custom-casting direct from original models. 4 pages. *Manco Products, Inc., 2401 Schaefer Rd., Melvindale, Mich.*

Monomeric epoxy plasticizers. Properties, performance characteristics, and recommended uses for Drapex 3.2 and Drapex 4.4, monomeric epoxy plasticizers. Bulletin 3. 26 pages. *Argus Chemical Corp., 633 Court St., Brooklyn 31, N.Y.*

Materials handling. Seven case studies of how various manufacturers solved production, storage, and shipping problems with modern materials handling equipment. 26 pages. *Lewis-Shepard Products, Inc., 125 Walnut St., Watertown 72, Mass.*

Alloys. Physical properties and conforming specifications for magnesium and aluminum alloys. Catalog 57. 24 pages. *The Wellman Bronze and Aluminum Co., 12800 Shaker Blvd., Cleveland 20, Ohio.*

Latest laminating advances. Survey of new developments—triple lamination, aluminized butyrate "sandwiches" with sealed-in color for thermoforming, etc. 4 pages. *Lamart Corp., 2 Waldo St., Clifton, N.J.*

"Physical Properties," 1958 ed., gives latest physical property data on more than 350 organic chemicals. Booklet F-6136. 28 pages. *Union Carbide Chemicals Co., 30 E. 42nd St., New York 17, N.Y.*

Polyethylene film. Prime conditions under which satisfactory heat seals can be made, and heat seal characteristics of various Petrothene polyethylene resins. "Heat Seal Characteristics of



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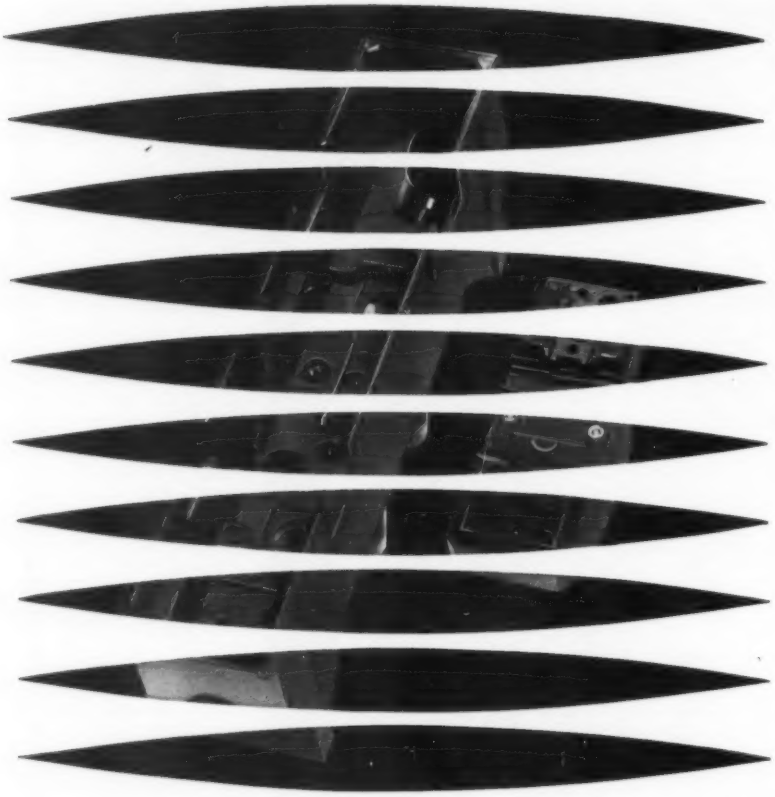
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Polyethylene Film." 16 pages. *U.S. Industrial Chemical Co., Div. of National Distillers and Chemicals Corp., 99 Park Ave., New York 16, N.Y.*

Petrochemicals. Descriptions and listing of typical properties of the company's line of petrochemicals for the plastics, paint, rubber, chemical, and other industries. 24 pages. *Amoco Chemicals Corp., 910 S. Michigan Ave., Chicago 80, Ill.*

Metal-clad laminates. Strengths, properties, and dimensions of the six most widely used grades of metal-clad laminates for printed circuitry use. 6 pages. *Synthane Corp., Oaks, Pa.*

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Industrial fasteners. Dimensional drawings and specifications on the company's full line of industrial fasteners. 8 pages. *Simmons Fasteners Corp., N. Broadway, Albany 1, N.Y.*

Paper. Uses and advantages of paper as a light, versatile, and economical material in product design. "Creative Imagination in the Development of Technical and Industrial Specialty Papers." 12 pages. *Knowlton Brothers, Watertown, N.Y.*

Cyclohexanol. Uses, physical and chemical properties, and principal reactions of Naxol cyclohexanol. Bulletin I-20. 32 pages. *National Aniline Div., Allied Chemical & Dye Corp., 40 Rector St., New York 6, N.Y.*

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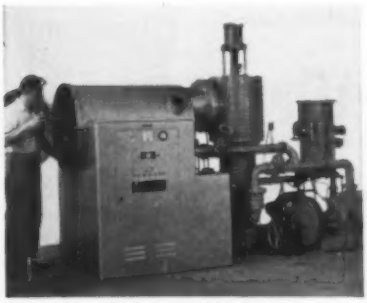
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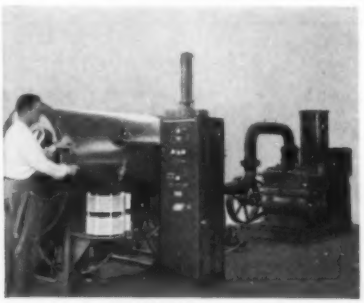
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"To Make Your Product Better" describes the relative merits of vinyl foam, urethane foam, and sponge rubber for use as weather sealing, cushioning, and dampening components. 12 pages. *Brown Rubber Co., Inc., Lafayette, Ind.*

Plastics finishing equipment. Specifications and applications of the Blastmaster barrel for mass-production cleaning of all types of plastics pieces and of the Roto-blast table for quick deflashing of fragile parts. Bulletin 228. 8 pages. *Pangborn Corp., Hagerstown, Md.*

Silicone guide. Over 150 commercially available silicone products with illustrated examples of how they can cut costs, simplify design, and add sales appeal to products in many fields. Code #1-113. 16 pages. *Dow Corning Corp., Midland, Mich.*

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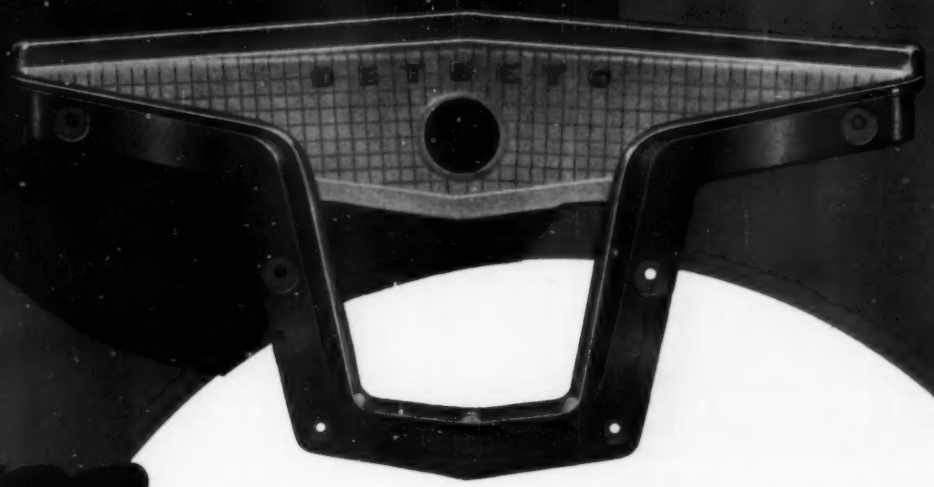
Stability of organic peroxides. Rates of decomposition at different temperatures and change in appearance of benzoyl peroxide, lauroyl peroxide, and methyl ethyl ketone peroxide. 7 pages. *McKesson & Robbins, Inc., Chemical Dept., 155 E. 44th St., New York 17, N.Y.*

Collapsible container handler. Sketches, illustrations, and text describe construction and application of a device designed to lift and carry Sealdbin containers. 4 pages. *Clark Equipment Co., Industrial Truck Div., Battle Creek, Mich.*

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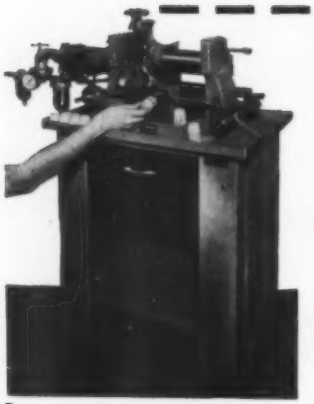
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Plastics

Production and sales in 1000 lb.* for September and October 1957

Materials	*Total p'd'n first 10 mos. of 1957‡*	*Total sales first 10 mos. of 1957‡*
Cellulose plastics:[a]		
Cellulose acetate and mixed ester		
Sheet, under 0.003 gage	15,885	15,485
Sheets, 0.003 gage and over	15,043	14,766
All other sheets, rods, tubes	6,132	5,868
Molding, extrusion materials	78,148	76,674
Nitrocellulose sheets, rods, tubes	3,386	3,436
Other cellulose plastics	4,755	4,186
Phenolic and other tar-acid resins:		
Molding materials[a]	153,319	156,295
Bonding and adhesive resins for:		
Laminating (except plywood)	51,053	40,163
Coated and bonded abrasives	14,050	14,234
Thermal insulation	44,346	44,518
Plywood	38,906	30,132
All other bonding uses¶	47,019	45,839
Protective-coating resins	25,412	21,426
Resins for all other uses	31,271	26,422
Urea and melamine resins:		
Textile-treating resins	29,226	28,899
Paper-treating resins	20,815	19,711
Bonding and adhesive resins for:		
Plywood	80,150	77,282
All other bonding and adhesive uses, including laminating	26,871	25,199
Protective-coating resins	30,334	22,982
Resins for all other uses, including molding	74,505	75,886
Styrene resins:		
Molding materials[a]	347,661	338,476
Protective-coating resins	69,782	66,485
Resins for all other uses	120,919	102,470
Vinyl resins, total[b]	694,750	635,839
Polyvinyl chloride and copolymer resins (50% or more polyvinyl chloride) for:		
Film (resin content)		80,768
Sheeting (resin content)		46,988
Molding and extrusion (resin content)		184,760
Textile and paper treating and coating (resin content)[c]		56,374
Flooring (resin content)		68,977
Protective coatings (resin content)		27,530
All other uses (resin content)		39,066
All other vinyl resins for:		
Adhesives (resin content)		35,426
All other uses (resin content)		95,974
Coumarone-indene and petroleum polymer resins	213,073	212,978
Polyester resins	77,919	71,002
Polyethylene resins	559,259	538,954
Miscellaneous:		
Molding materials[a, d]	40,381	40,166
Protective-coating resins[e]	11,056	5,494
Resins for all other uses[f]	111,906	101,466

*Dry basis designated unless otherwise specified. †Revised. ‡Partially estimated. ¶Includes friction materials. [a]Includes fillers, plasticizers, and extenders. [b]Production statistics by uses are not representative, as end use may not be known at the time of manufacture. Therefore, only statistics on total production

Production

From statistics compiled by the U. S. Tariff Commission

September†		*October‡*	
Production	*Sales*	*Production*	*Sales*
1,716	1,742	1,347	1,568
1,693	1,579	1,639	1,740
777	681	828	714
9,098	8,575	9,663	9,657
281	292	330	345
495	457	546	552
14,669	14,471	20,667	25,133
5,225	4,193	5,476	4,888
1,336	1,533	1,488	1,851
4,411	4,639	4,707	5,257
4,167	3,169	3,834	3,531
4,752	5,202	5,825	6,041
2,653	2,257	2,957	2,358
2,846	2,378	3,321	2,873
2,649	2,686	3,143	3,248
1,868	1,897	1,704	1,866
8,665	8,643	9,379	8,439
2,928	2,887	3,490	3,360
2,921	2,370	3,556	2,568
7,376	7,747	8,217	8,755
37,485	36,669	39,659	37,986
6,661	6,651	8,647	7,100
11,011	10,286	13,758	12,735
72,238	65,258	77,088	73,249
	9,406		10,747
	4,987		5,102
	18,653		21,712
	6,542		6,802
	7,156		7,506
	2,363		2,256
	4,189		4,466
	3,191		3,771
	8,771		10,887
21,680	21,134	23,088	22,786
6,664	6,508	7,976	7,095
60,183	53,107	65,552	66,806
4,197	4,272	5,075	4,822
1,096	625	1,156	609
11,678	9,545	12,606	10,663

are given. [c]Includes data for spreader and calendering-type resins. [d]Includes data for acrylic, nylon, and other molding materials. [e]Includes data for epichlorohydrin, acrylic, silicone, and other protective-coating resins. [f]Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.

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non-migratory
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excellent dry blending
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can be used as sole plasticizer

physical data		heat stability (180°C.)	
100% Modulus	1320 psi	Initial Discoloration	15 min.
Tensile Strength	2695 psi	Maximum Discoloration	90 min.
Elongation	338%	**extraction loss**	
Hardness, Shore A	80	Water	0.21%
T_f	−17.3°C.	1% Soap	3.45%
Flux Time	45 seconds	Mineral Oil	2.10%

migration

Lacquer, 25°C., 14 days	Very slight softening
Varnish, 25°C., 14 days	No effect
Polystyrene, 60°C., 19 days	No effect

Harflex 325 polymeric plasticizer

economical
non-migratory, permanent

physical data		heat stability (180°C.)	
100% Modulus	1320 psi	Initial Discoloration	15 min.
Tensile Strength	2471 psi	Maximum Discoloration	90 min.
Elongation	350%	**extraction loss**	
Hardness, Shore A	76	1% Soap	2.6%
T_f	−12.5°C.	Mineral Oil	1.2%
Flux Time	60 seconds		

migration

Lacquer, 25°C., 14 days	Slight staining, very slight softening
Varnish, 25°C., 14 days	Slight staining
Polystyrene, 60°C., 19 days	No effect

Both these Polymerics are used with Vinyl Chloride Polymers and Copolymers, Polyvinyl Acetate, Synthetic Rubbers, Nitrocellulose, Cellulose Acetobutyrate, and Polymethyl Methacrylate.

Harchem produces a full line of phthalate, adipate, sebacate and polymeric plasticizers in addition to the plasticizers shown.

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COLOR CONCENTRATES FOR EPOXY RESINS. Folder discusses use of company's liquid epoxy paste color concentrates used as a colorant for epoxy resins in casting and laminating applications. Lists resin suppliers, prices. Ferro Corp. **(B-801)**

INJECTION PRESSES. Folder provides illustrations and specifications for company's 2, 4 oz. injection presses, points out design features. Moslo Machinery Co. **(B-802)**

MELTING EQUIPMENT. 8-page illustrated booklet describes melting equipment for resins, waxes, adhesives, and similar materials, including rectangular tanks, agitators, heaters, low pressure tanks. Sta-Warm Electric Co. **(B-803)**

POLYESTER RESINS. Handbook describes characteristics of "Glidpol" line of polyester resins. Applications described include laminating, casting, impregnating, surface coating. The Glidden Co. **(B-804)**

INJECTION PRESSES. Illustrated brochure gives features and specifications of line of 4, 8, 12, 20, 60 oz. injection molding presses. Specifications chart included. The Lester Engineering Co. **(B-805)**

PACKAGING HEAVY PRODUCTS. 48-page illustrated booklet contains case history studies on the packaging of heavy products such as pumps, machine parts, motors, plastics and nails, in corrugated boxes. Illustrates several corrugated box styles. Hinde & Dauch. **(B-806)**

PROCESSING EQUIPMENT. Literature describes injection presses with 1, 2, 2½ oz. capacities. Also describes company's base assemblies and a scrap granulator. The Van Dorn Iron Works Co. **(B-807)**

INFRARED HEATERS. Illustrated catalog describes method of achieving adjustable-area heat radiation through use of interchanging infrared elements of varying sizes in any of a number of standard housings. Installation data, dimensions, prices, list of accessories included. Edwin L. Wiegand Co. **(B-808)**

TENSILE TESTING INSTRUMENTS. Series of technical bulletins on a group of testing instruments and accessories for measuring tensile strength, flexure and compression data. Price lists included. Instron Engineering Corporation. **(B-809)**

VINYL STABILIZER. Technical data lists properties and applications for a barium zinc compound with primary applications in calendering, extrusion, floor tiling. Advance Solvents and Chemical. **(B-810)**

ELECTRONIC HEAT SEALER. Illustrated brochure describes and gives specifications for an electronic heat sealer. Includes sample of intricate three-dimensional multi-color work produced on machine. Cosmos Electronic Machine Corp. **(B-811)**

DOUBLE ROTATION OVENS. 4-page leaflet gives details of design, function, operation, and much technical data on a heavy-load rotation oven for measured molding of vinyl plastisol. E. B. Blue Company. **(B-812)**

POLYVINYL ALCOHOL. 20-page technical manual on 12 grades of a polyvinyl alcohol gives details on properties, reactions, modifications, and on uses as coatings, molding materials, films, emulsions, adhesives and binders. Shawinigan Resins Corp. **(B-813)**

HIGH-IMPACT THERMOPLASTIC RESIN. Specially designed folder contains reference material on electrical, chemical and physical properties of 5 types of impact-resistant thermoplastic resins for molding, extruding, calendering. Price schedules included. Marbon Chemical, Div. Borg-Warner Corp. **(B-814)**

SILICONES GUIDE. 16-page catalog describes over 150 commercially available silicone products, including many introduced within this past year. Contains detailed charts, tables, graphs and data on properties and performance, along with illustrated examples of how silicones can cut costs, simplify design. Dow Corning Corp. **(B-815)**

PRODUCT DECALS. Folder gives information on two adhesive films, yellow or white vinyl, and metalized chrome-tint "Mylar" polyester which can be printed, silk-screened or die-cut and used for plastics product identification or decoration. Fasson Products. **(B-816)**

POLYSTYRENE FOR MACHINING. Pamphlet describes high-impact rod in diameters up to 2¾ inches, tubing in diameters up to 3 inches, and sheet up to 2 inch thickness, for the machining of small parts. Westlake Plastics Co. **(B-817)**

ROTARY BATCH BLENDERS. 4-page illustrated leaflet describes features, gives specifications on batch-blenders for dry or semi-dry materials with drum-mixing capacities from 500 to 4,000 lbs. Sturtevant Mill Company. **(B-818)**

CIRCULAR-FORM GRINDERS. Leaflet presents features, specifications, and suggested applications for a lathe-like automatic, preset centerless grinder for fabrication of bowls, spools, knobs, beads, spindles, etc., and designed for duplication on stock up to 5" in diameter. Glebar Co. **(B-819)**

INDUSTRIAL TEMPERATURE CONTROLS. Condensed catalog of temperature controls and allied equipment for industrial heating and refrigeration, presents detailed information on recording, indicating, electrical and mechanical non-indicating instruments. Specifications and prices are included. The Partlow Company. **(B-820)**

AUTOMATIC TEMPERATURE CONTROLS. Leaflet describes a line of temperature controls, steam traps, strainers, cooling controls, and a fully-automatic unit for controlling the face temperature of molds, rolls, cylinders and drums. Sarco Company, Inc. **(B-821)**

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HEAVY DUTY GRANULATORS. Brochure presents features in a line of heavy duty plastics granulators with capacities ranging from 500 to 2500 pounds per hour. Chart gives specifications. Ball & Jewell, Inc. **(B-822)**

MARKING MACHINES. Catalog lists full line of marking, numbering and stamping equipment of use in the plastics field for marking material from molds and dies, branders for plastics, wood, leather, accessories such as inks, stamping dies. Included are a stamping pressure chart, specifications, features. Acromark Co. **(B-823)**

COLORED COATINGS FOR PLASTICS. Folder gives instructions for applying an epoxy coating to plastic products, a coating which is available in a range of colors, including metalics and opalescents, and is for use where chemical, corrosion and abrasion-resistance are important. Rexton Finishes, Inc. **(B-824)**

PUMPS FOR POTTING AND CASTING. Leaflet gives information on a line of automatic pumps which proportion, mix, meter and dispense two-part resin compounds for casting, encapsulating, potting, sealing and setting. Hardman Co. **(B-825)**

TEMPERATURE INSTRUMENTS. Illustrated catalog shows a selected line of temperature recorders, controllers, indicators, control systems and accessories, and gives a brief description of the function of each instrument. West Instrument Corporation. **(B-826)**

LARGE MOLDS. Illustrated leaflet describes a precision mold making service for large aluminum and bronze molds used in reinforced plastics molding operations. M. A. Cuming & Co., Inc. **(B-827)**

PARTS MOLDING. 14-page brochure gives information about a custom injection molding service for thermoplastic parts up to 200 ounces. Also includes data on company's screening, stamping, roller-coating, spraying and metalizing facilities. Nosco Plastics, Inc. **(B-828)**

HIGH IMPACT THERMOPLASTIC RESIN. File folder contains reference material on the electrical, chemical and physical properties of five types of acrylonitrile-butadiene-styrene resin for molding, extruding and calendering. Price schedules included. Marbon Chemical, Div. Borg-Warner Corp. **(B-829)**

STICKY MATERIALS FEEDER. 4-page illustrated folder supplies full information on a mechanical feeder designed for continuous flow of damp, oily, lumpy friable, or semi-plastic materials from bin to point of discharge. Design applications are discussed. Pulva Corporation. **(B-830)**

ELASTOMERIC ADHESIVE FACILITIES. 10-page publication describes Elastomeric adhesive production facilities for manufacturing special-purpose, solvent-based, pressure-sensitive and solvent-activated adhesives. Johns-Manville, Dutch Brand Div. **(B-831)**

LEAD-FILLED EPOXY RESINS. Technical bulletin on a lead-filled epoxy casting material emphasizes its usefulness in fabricating radioactivity-shielding containers and structures, summarizes properties and lists available formulations. Marblette Corp. **(B-832)**

FILM ADHESIVES. Report describes adhesives in a dry film form for flat surface bonding of metals and plastics. Included is technical data applying to 4 and 11 mil films and information on reactivation methods to achieve bonds. Rubber & Asbestos Corp. **(B-833)**

HYDRAULIC FLUIDS. 24-page booklet describes characteristics of hydraulic fluids and hydraulic systems and covers such subjects as viscosity recommendations, corrosion and rust prevention, reservoir requirements, and maintenance. Vickers, Inc. **(B-834)**

SPECIALIZED DRIVES IN MOTORS. 12-page booklet discusses specialized drives in electric motors, AC motors to 400 hp, DC units to 1,000 hp, DC and AC generators and motor generator sets, gear motors in variable speed drive systems, and their control. Reliance Electric & Engineering Co. **(B-835)**

COMPACTING MILL. Bulletin describes mechanical means for converting or upgrading particle size, and for controlling product density and product solubility factors. It also refers to such processing equipment as a granulating mill, vibrating screen and gyratory screen used independently or with a compactor. Allis-Chalmers. **(B-836)**

CUSTOM CASTING. Pamphlet describes method of precision casting mold and die components in steel and other castable metals direct from expendable original patterns. Manco Products, Inc. **(B-837)**

VINYL PLASTICIZER. Bulletin describes a light-colored petroleum product useful as a plasticizer with vinyl resins and which may be used in some instances for partial replacement of ester plasticizers. Property specifications, charts included. Kenrich Corp. **(B-838)**

SEBACIC ACID PLASTICIZERS. 10-page illustrated brochure presents the specifications and recommended uses for 18 special purpose plasticizers, and contains a 2 page ready-reference chart showing comparison of their physical properties. Harchem Div., Wallace & Tiernan, Inc. **(B-839)**

DUST COLLECTORS. Illustrated booklet presents line of dust filtering units with capacities ranging from 640 to 5000 cubic feet per minute. Gives features and specifications. Pulverizing Machinery Div., Metals Disintegrating Company, Inc. **(B-840)**

VINYL PLASTISOL. 12-page booklet discusses production methods, recommended uses, and provides properties chart for line of "Chem-O-Sol" vinyl plastisols. Chemical Products Corp. **(B-841)**

VINYL CUSHION MACHINE MOUNT. Illustrated 12-page brochure describes a vinyl-sisal-cork "Air-Loc" pad upon which machine is mounted to absorb vibrations and shock loads. Includes illustrations. Clark-Cutler-McDermott Co. **(B-842)**

ELECTROFORMED MOLDS. Bulletin describes how to prepare electroformed molds for vacuum forming of plastics. Also discusses application and special features of these molds. T. V. Jay Company. **(B-843)**

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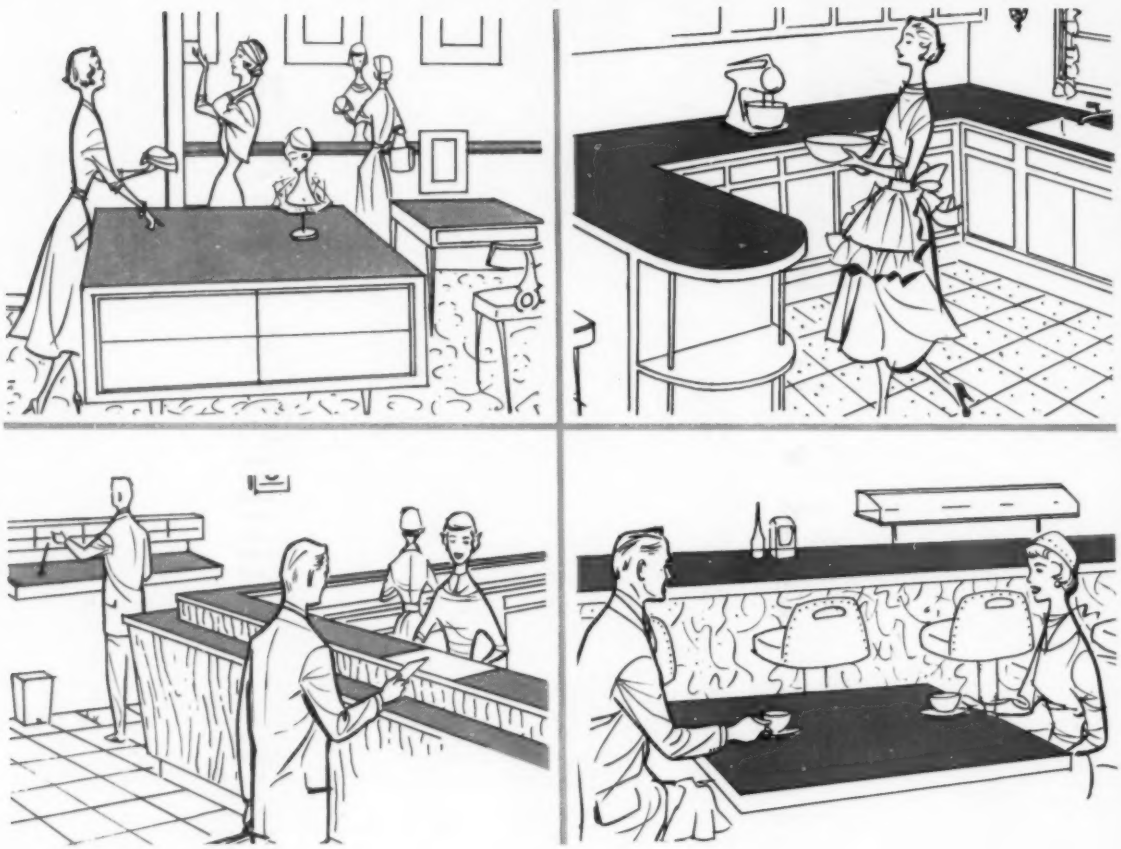
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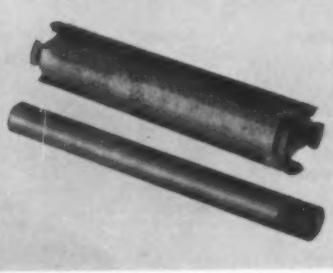
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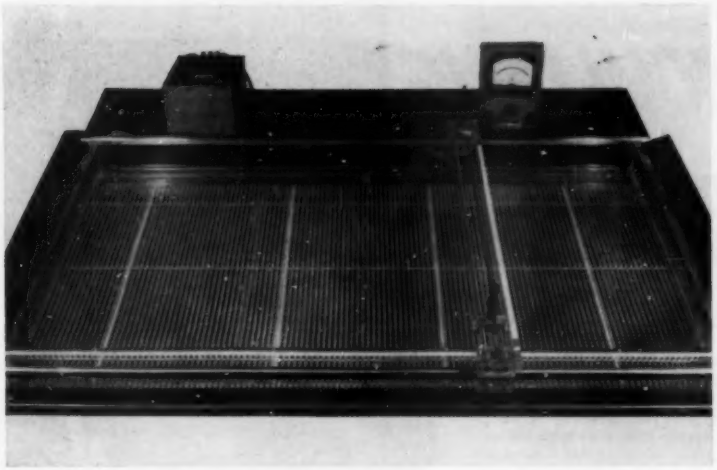


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The acrylic sheet, 3 ft. by 5 ft. by 1 in. thick, serves as the base plate of a 3-in.-deep electrolyte tank. The principal problem in the fabrication of this base plate was the accurate locating and drilling of 7920 holes through which electrodes contact the electrolyte. Each hole was first sunk to a depth of 0.5 in. with a 0.25-in. drill. The point in the bottom of this hole was used to locate the second drill, 0.068 in. in diameter, which penetrated to the opposite side. The two holes had to be concentric to ±0.002 inch.

After the holes were finished, 7920 stainless steel inserts were force fitted—they had to be liquid tight—into the 0.250-in. holes.

Flatness of the finished sheet had to be within ±0.015 inch. To get down to this tolerance from the normal variation of ±0.080 in. in the 1-in. acrylic sheet, the surface was milled with a ¾-in. end mill fitted in a high-speed milling head. After each pass, the head was loosened, moved over ⅝ in., and then refastened. It was necessary to make 72 passes for each of three total passes over the sheet surface. After this milling operation, the surface was finished by hand scraping and liquid polishing. Then all chips had to be removed from tiny threaded holes in the steel inserts. This was accomplished with a hypodermic needle connected to an air compressor. Finished plate surface was flat to within ±0.008 in. over the entire 3- by 5-ft. area.

Credits: Sheet from Commercial Plastics and Supply Corp., New York, N.Y., Fabrication by Comco Plastics, Inc., Ozone Park, N.Y., in cooperation with the computer's designer, Nuclear Development Corp. of America.



Analogue computer designed to solve problems of heat conditions in the interior of nuclear reactors. (Photos, Commercial Plastics and Supply Corp.)

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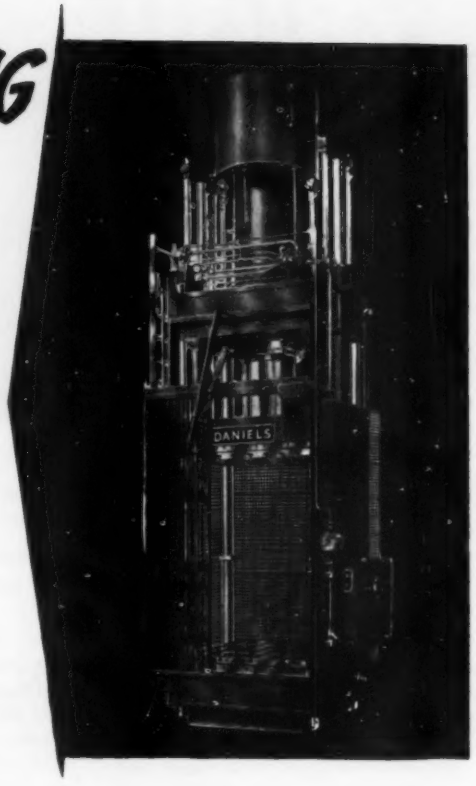
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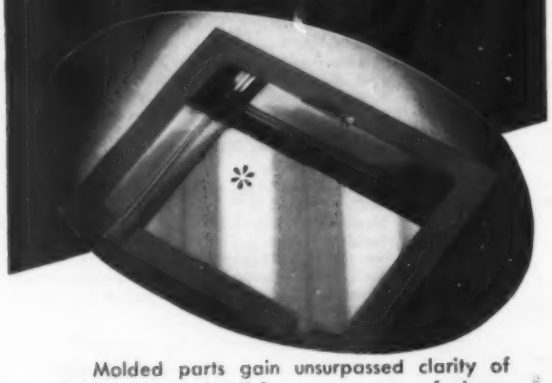
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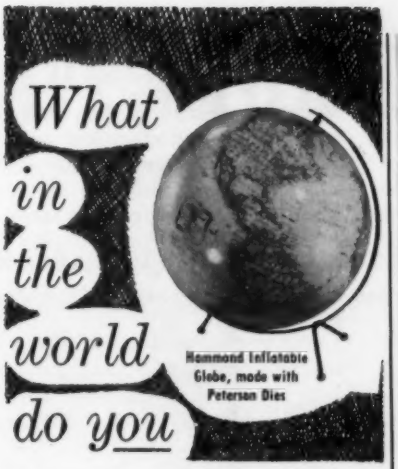
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PVC sediment strainer

The growth of PVC pipe usage in corrosive-service applications has been given new impetus with the development of rigid PVC sediment strainers. These new fittings solve problems of corrosion and electrolytic action associated with metal fittings.

As manufactured by Walworth Co., 60 East 42nd St., New York 17, N. Y., the strainer consists of three parts: body, screen, and cap. The body is molded in a single-cavity mold on a 40-oz. injection machine; the cap is machined from extruded PVC bar stock; the screen, produced from 1/32-in. PVC sheet and perforated with 234 1/32-in. holes per square inch, is formed into a cylinder on a mandrel and solvent cemented to the cap. A molded polyethylene gasket around the cap neck provides a leakproof closure. To assure capacity flow, the open area of the perforated screen is calculated to be at least twice that of the cross sectional area of corresponding schedule 80 pipe. Even if half the holes are plugged up, full flow continues.

The strainer is offered with threaded solvent-weld socket-type or flanged ends in five sizes from 1/2- through 2-in. diameters. Service ratings are 150 p.s.i. at 75° F. and 75 p.s.i. at 150° F.

Credit: Molding and extrusion to Walworth specifications by General American Transportation Corp., Chicago, Ill.

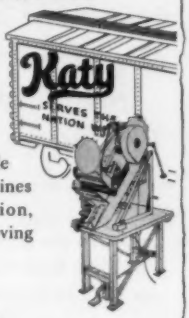
How

MARKEM

solves typical problems in

IDENTIFICATION and DECORATION

marking model railroad cars



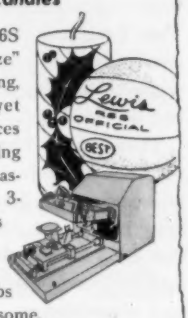
Several leading U. S. toy makers had used decals (costly both to buy and apply) on their replica model train cars. Authentic imprints are now made by Markem 25A machines —speeding production, lowering costs, improving looks.

imprinting food container lids



Bothered by the cost, delivery and inventory problems caused by short run lid printing jobs done "outside", a food retailer now prints the lids he needs *as* he needs them, using several 45ABE machines. Supply now matches demand, with the right marking method.

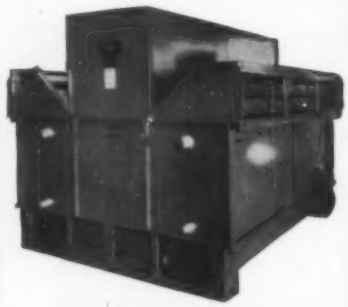
screen process printing: basketballs . . . to candles



Markem 90S and 106S machines "mechanize" screen process printing, giving fine detail yet heavy coverage. Surfaces and shapes now being marked range from basketballs, candles and 3-color instrument dials to play shoes, plastic bottles and billfolds. Excellent for many jobs —the *only* method for some.

These are typical of the thousands of marking problems Markem solves every year for all types of industries. The benefits of 46 years of experience are applied to every job—and can be to yours. Write Markem Machine Company, Keene 20, N. H.

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Write for Niagara Bulletin No. 132

NIAGARA BLOWER COMPANY
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NEW YORK 17, N. Y.
District Engineers in Principal Cities of U. S. and Canada

Chrysler checks its cars with plastics

A major automobile manufacturer has turned to plastics as a means of simplifying various of its test procedures that have to be conducted before a car is put into actual production.

As developed by Chrysler Corp. for its line of vehicles, the new test method involves the use of an accurately scaled, transparent, all-plastics model. The model, about 6 ft. long, is an exact replica of the car being investigated, but scaled to about ⅜ of the actual size.

With the model, structural parts of an automobile, previously extremely hard to get at and measure, can now be studied easily and precisely, and necessary design changes made without the delay entailed with other methods.

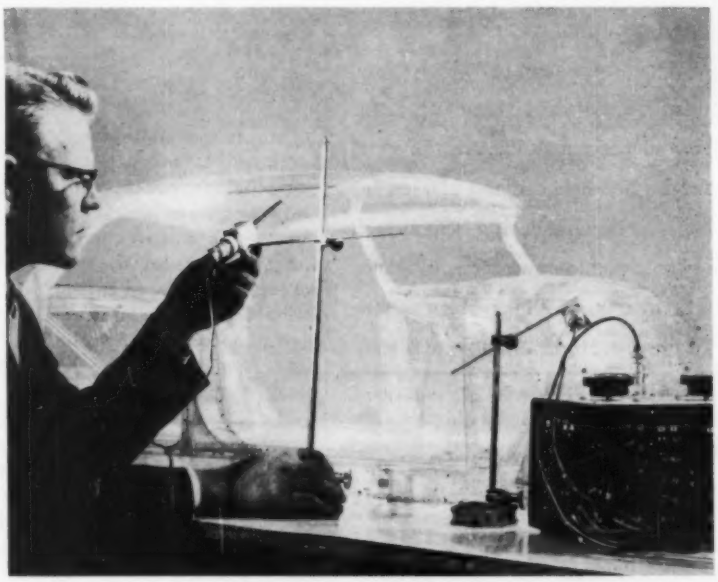
The test model is produced from components vacuum formed of rigid vinyl, acetate, butyrate, and methacrylate, the specific material choice depending on three factors: 1) ease of fabrication, 2) consistency of physical properties, and 3) availability in a wide range of thicknesses.

When assembled, the model permits accurate checking of structural strength of body shells, underbodies, and other key parts of the car. Different weights are attached to various parts of the plastic chassis and readings taken by means of transducers employing wire strain gages and designed to operate under very light loads.

Engineers can mathematically magnify these readings and translate them to equivalent values that would apply to steel frames of regular cars. With the data obtained, and using a system of mathematical conversion factors devised by Chrysler engineers, the effect of any twist, bend, or deflection that may occur on the actual automobile can be studied in the plastics model.

From knowledge obtained in these plastics model studies, designs and materials for full-size steel cars can be changed and retested efficiently before the final production go-ahead is given.

While at present confined to the automotive field, this testing method seems equally applicable to structural strength studies involving bridges, buildings, planes, and load-carrying members in general.



Engineer preparing test for structural strength on all-plastics scale model of Chrysler car. Data obtained on the 6-ft. replica are used to determine whether any design changes have to be made in the actual steel-frame chassis. (Photo, Chrysler Corp.)

SAVE MORE TIME AND MONEY

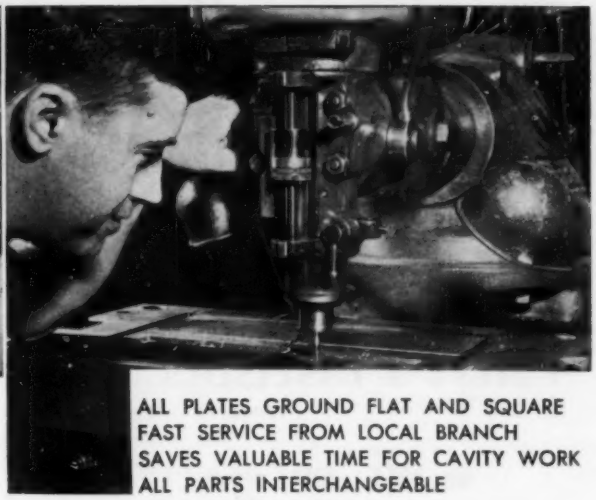
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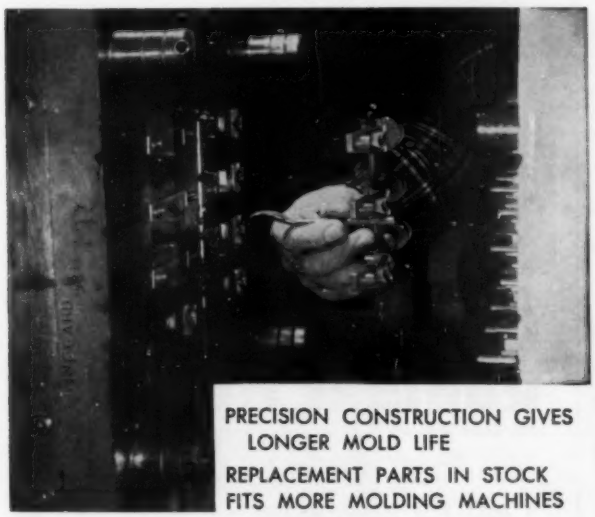
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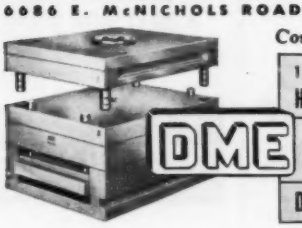
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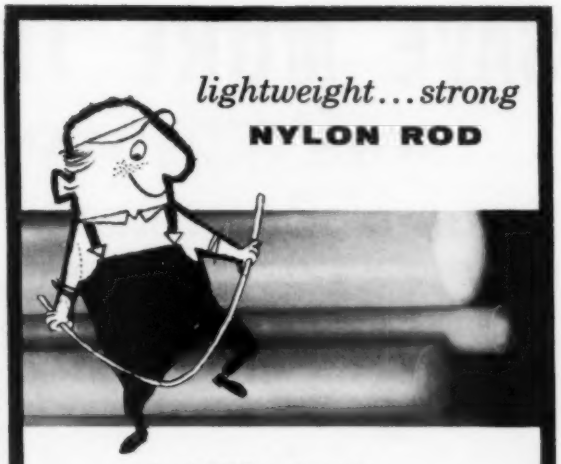
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Polyethylene film 0.005 in. thick appears to be a solution to the problem of packaging seeds of corn, wheat, and certain vegetables so as to protect their viability during storage. Unprotected seeds tend to sprout or decay when exposed to warm, damp air. Involved are an estimated 50 million bushels of seeds which each year must be protected against moisture during storage and shipment.

Small-size moisture-barrier film bags were tested in atmosphere chambers at up to 95% relative humidity and 104° F. temperature. Of the various gages tested, it was found that film 0.005 in. thick offered sufficient resistance to moisture penetration to provide as much as a fourfold increase in seed storage life over conventional packaging materials. In other tests, special 50- and 100-lb. bags survived rugged handling and storage procedures without noticeable physical damage.

The specially designed and constructed large bags were made of tubular stock, and a new type of seal was developed for the tops.

Credits: Research was carried on at the Development Laboratories of Bakelite Co., Div. of Union Carbide Corp.



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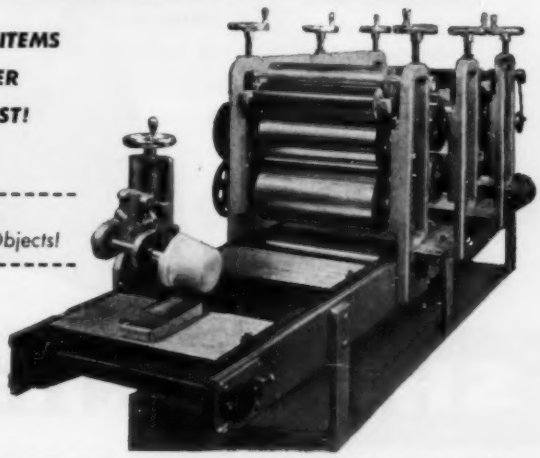
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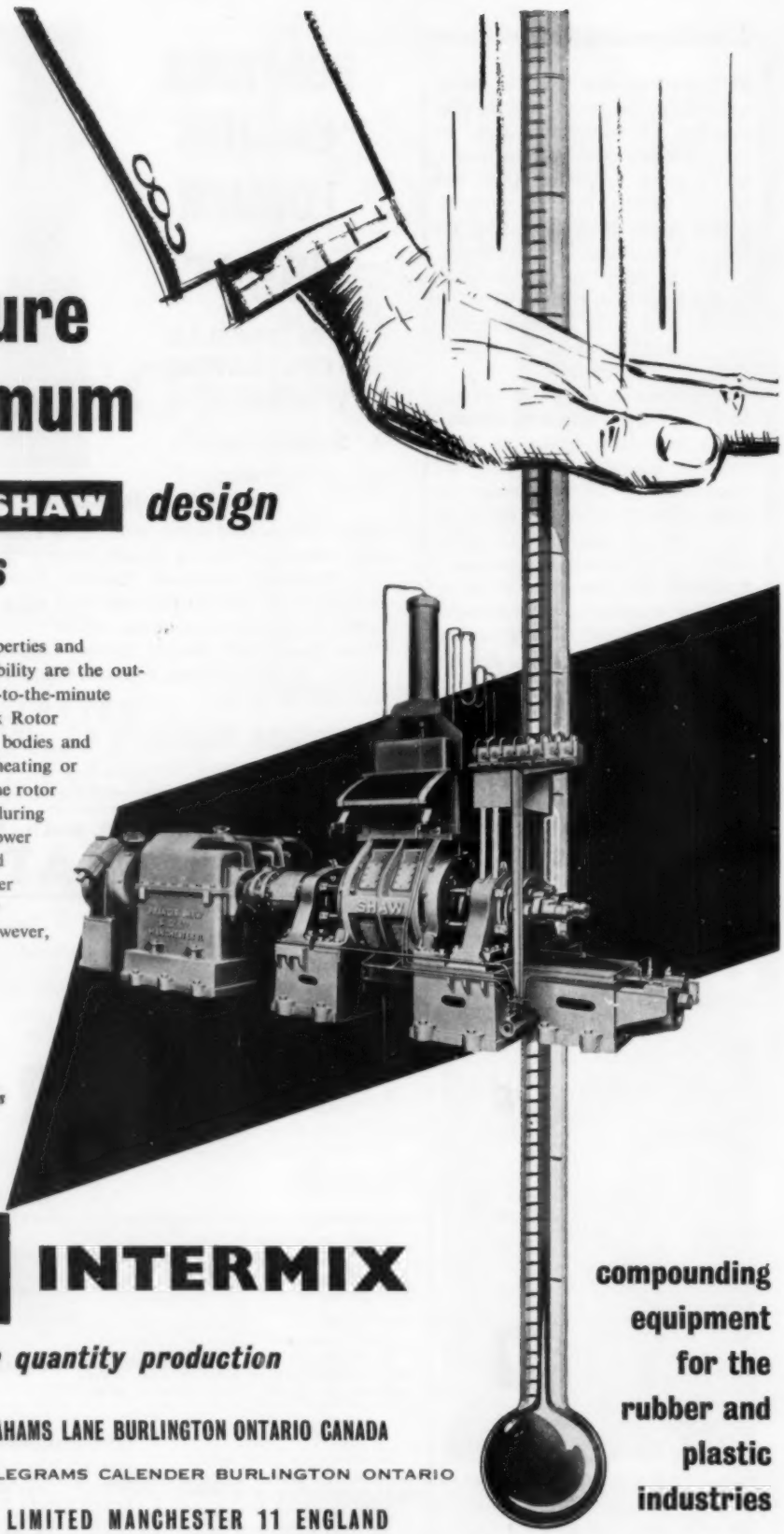
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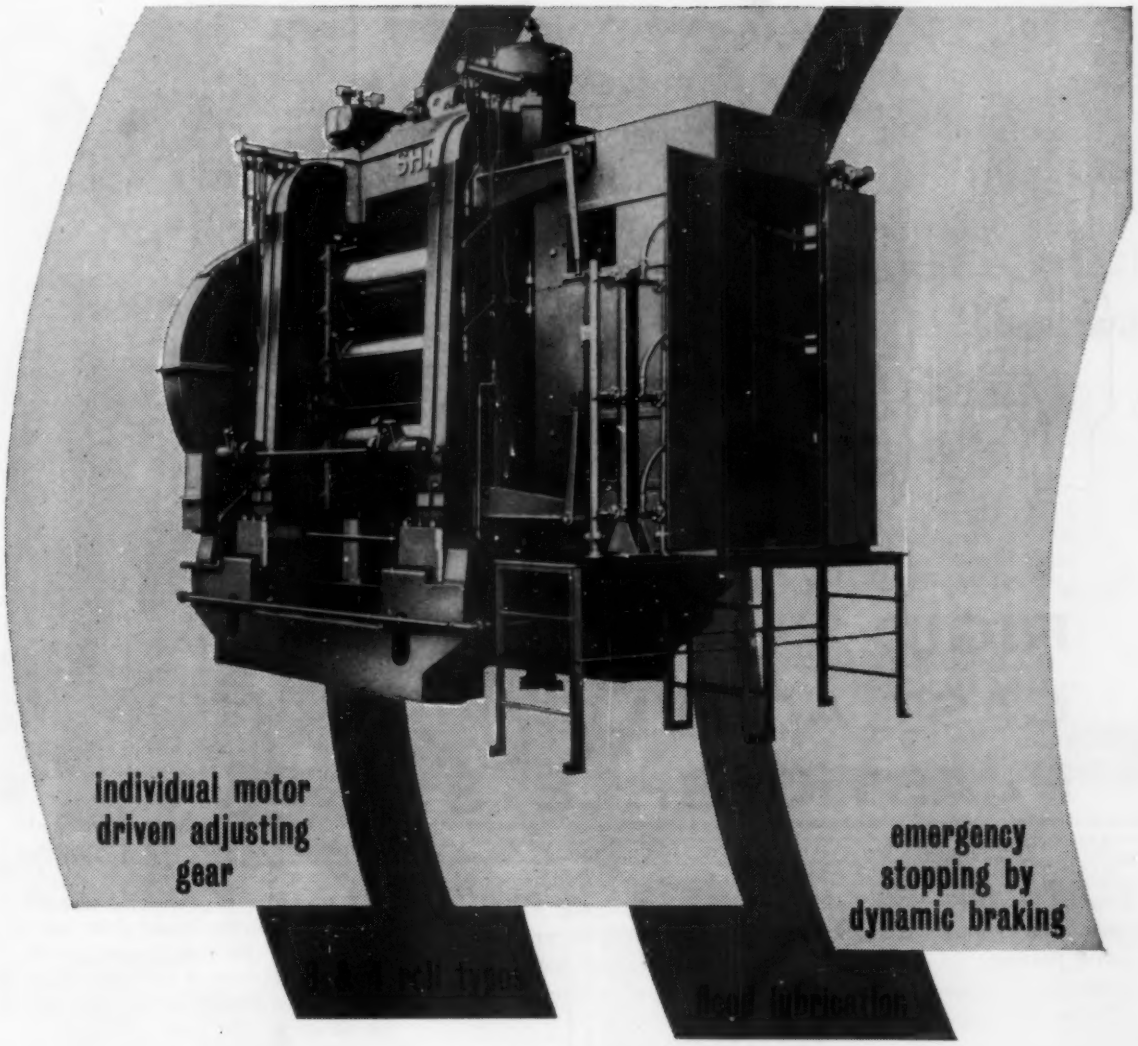
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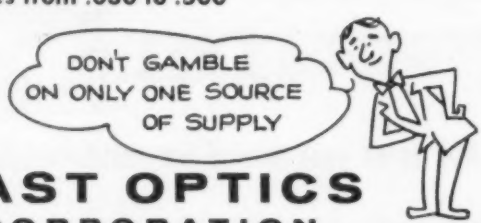


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Globe within globe gives ingenious space-eye view of earth and sky. Outer sphere can be used to demonstrate orbits of man-made satellites

Earth-Sky globe

The orbits of Russian sputniks and American satellites—those now aloft and yet to be launched—can be demonstrated graphically with an inexpensive but scientifically designed earth-sky globe.

The device consists of two transparent acrylic globes mounted one within the other on a polar axis, with a map of the earth printed on the inner globe and a detailed star map printed on the inside surface of the outer globe. The earth globe is turned by a knob on the axis, and a sun pointer is provided between the two globes to indicate the position of the sun for any particular date.

Establishing the orbit of a satellite on the earth-sky globe is done in three steps: 1) the sun pointer is placed at the current date as indicated on the eliptic circle of the globe; 2) the earth is moved to the time position of a known geographic crossing of the satellite; 3) using this time-fix, a great circle is drawn through this point on the star globe at the proper angle to the equator.

The globes can be marked or colored with crayon or water color, and easily cleaned with cotton or a chamois.

Credits: Manufactured by Farquhar Transparent Globes, 3724 Irving St., Philadelphia 4, Pa., of Plexiglas acrylic from Rohm & Haas.

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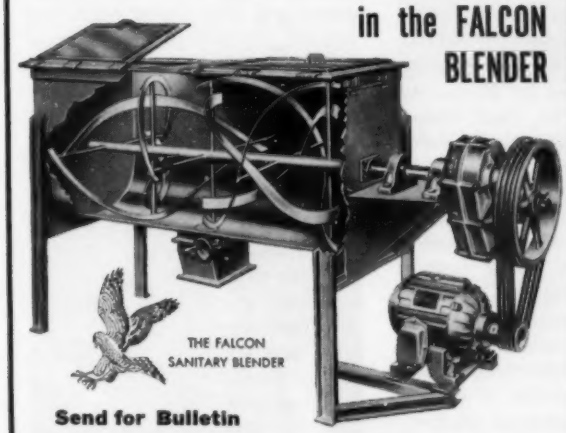
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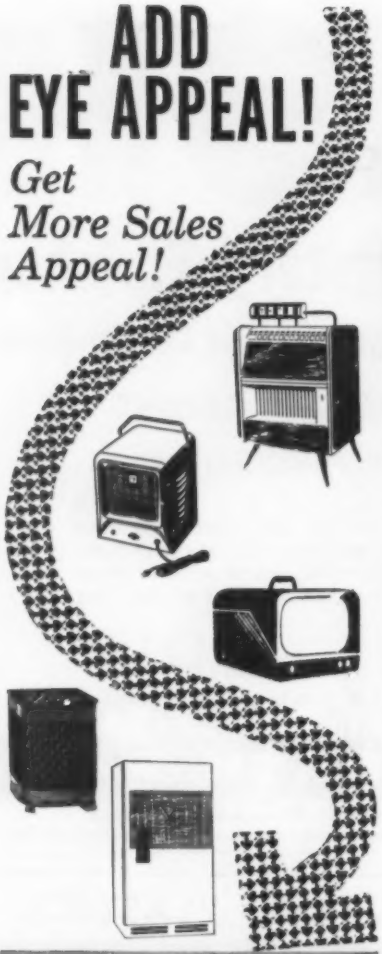
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Handsome reinforced plastics cabinet dresses up new Motorola portable radio-phono unit. The case combines "built-in" color and good looks with light weight and excellent serviceability.

Radio-phono cabinet of reinforced plastics

An important advance for reinforced plastics in the appliance field is seen in a new cabinet for a Motorola radio-phono combination manufactured by Minnesota Mining & Mfg., St. Paul, Minn. Reinforced plastics have many desirable properties for use in such large portable units—light weight, durability, permanent color, and outstanding resistance to impact, shock, heat, stains, moisture, and abrasion.

In the new Motorola cabinet, it was possible to combine smooth good looks with light weight because of the flexibility of design possible with reinforced plastics. The cabinet weighs only 7½ pounds.

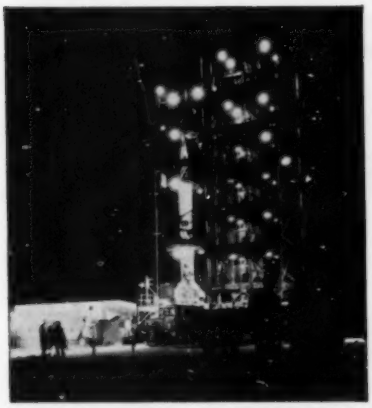
According to 3M's Reinforced Plastics Div., the decision to use reinforced plastics to house the radio-phono was based in part on military acceptance of the acoustical properties of polyester resin reinforced with fibrous glass. H. J. Tierney, vice president of the division, said that commercial use of the new cabinet by Motorola marks the beginning of wide use of reinforced plastics products in the electrical appliance field because the material is non-conductive, in addition to having the other advantages mentioned above.



Impact strength of cabinet is demonstrated by mallet blow. Force of blow shows in recoil of mallet and bouncing tumbler at left. (Photos, 3M)

PRODUCT-DESIGN MEMOS FROM DUREZ

Insulative molding compounds | **Corrosion-resistant polyester** | **Low-cost control knobs**



Official U. S. Navy photo

But what if it rains?

From time immemorial, weather has upset the military plans of men. In colonial days, wet gunpowder could lose a skirmish. Today, one moisture-affected part can nullify months of costly labor on a new missile.

This helps to explain the increasing pressure on moisture-resistant insulations for electronic parts that must not fail. It explains, too, the growing interest in a relatively new Durez molding material, *diallyl phthalate*.

This is the *only* plastic that retains its high insulation values over extended periods at relative humidities above 90%.

Its arc resistance, as measured by ASTM D495 (Method A or B), can be consistently reproduced.

It does not corrode metal contact points.

Because it is a thermosetting material, it provides virtual freedom from cold flow and creep.

You can get this material from us as an orlon-filled granular blue or green molding compound with plasticity values of 10, 12, or 16 by ASTM D731. It is designed to meet the requirements of Mil-M-18794, Type SDI-5.

For a data sheet detailing properties of the compound, and of molded material, check the coupon.

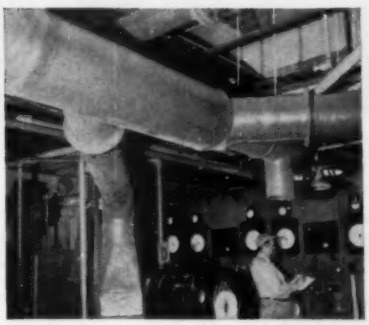
Hetron® ducts outlast metal

Perhaps you've been thinking of Hetron mainly as a *fire-retardant* polyester material.

It's true you get outstanding fire retardance with Hetron. But don't overlook its *corrosion resistance*, which is equally impressive in equipment such as this glass-reinforced ductwork manufactured by duVerre, Inc.

Venting corrosive fumes from a chemical reactor, aluminum ducts failed in 11 months. Ducts made of Hetron 92 replaced them—and have gone 17 months without a sign of deterioration.

In another plant, Hetron 92 replaces rubber-lined steel ductwork which lasted

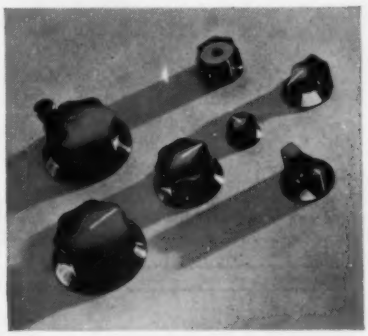


duVerre, Inc.

less than a year under the corrosive bite of wet chlorine. The Hetron ductwork, in service four years, has required no maintenance and is as sound as the day it was installed.

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For more information on Durez materials mentioned above, check here:

- ☐ Diallyl phthalate, Durez 16694
- ☐ Hetron polyester resins (bulletin)

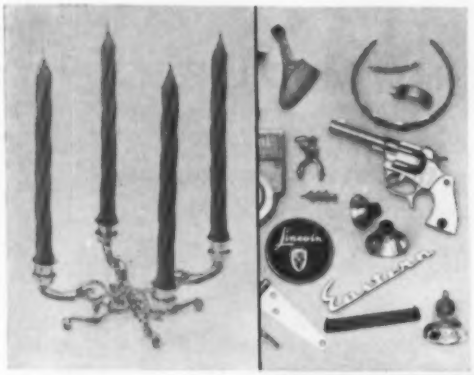
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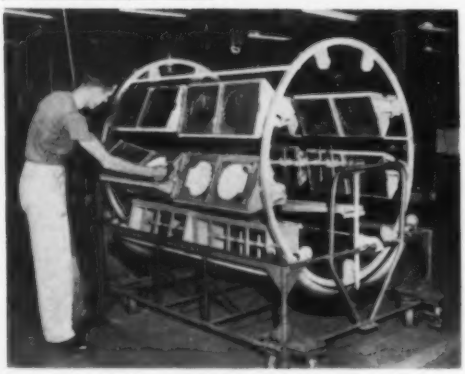


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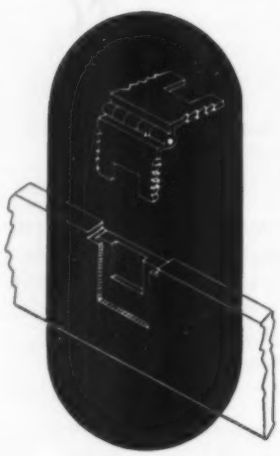
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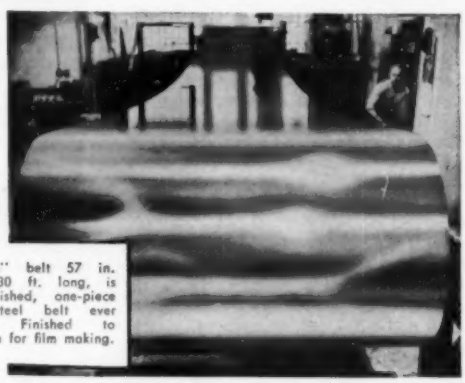
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Peek-a-boo shoe

Polyethylene usage for footwear components, already responsible for an estimated annual consumption of 3 million lb. of resin, is being given additional momentum with the recent introduction of a new and powerful sales tool: the transparent demonstration shoe shown above.

To the customer, seeing is believing. Yet when it comes to shoes, he is generally as ignorant about the inside of his footwear as the infidel is of the interior of Mecca. But no longer need he be in the dark. Endicott-Johnson Corp., Endicott, N. Y., has now produced for its salesmen a look-through shoe that reveals to the prospective purchaser all the inside parts, in particular those made of polyethylene, that are usually hidden from view.

This visibility is achieved by the use of clear extruded 80-mil vinyl sheet for the outer shell instead of the conventionally used leather. Readily observable through this transparent covering are the various molded polyethylene parts whose location, function, and advantages the salesman can point out to his prospect. These parts include the following: The counter, which forms a tough flexible cup around the heel (Du Pont Alathon 16); the insert (Dow 900-M), which forms a rigid arch and heel support; the toe lining (Dow 900-M); the midsole (Dow 990-M); the heel base (Koppers 3700), to which the heel is fastened; and the dutchman (Dow 990-M), another heel component.

All of these various polyethylene parts are injection molded by Endicott-Johnson.

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Plastics ahoy!

(*From pp.* 87-95)

president of Winner, reports his company enjoyed peak-volume business last year and expects to turn in an even better performance in the production of plastics boats in 1958.

Planned production

The Lone Star Boat Co. uses contact molding combined with sophisticated manufacturing processes (complex piping to convey the polyester resin to the layup area, a curing oven, moving conveyor belts) to produce its line of rakish runabouts, fishing boats, and cabin cruisettes. In its boat design, Lone Star makes good use of complex curves difficult to achieve with wood. The company produces both aluminum and plastics boats, but increased its production capacity for reinforced plastics boats fourfold last year.

Lone Star is adding another major plant at Tallahassee, Fla., in addition to its installations at Grand Prairie, Texas, and Raymond, Ind. The new plant, which should be in operation before this article is in print, features temperature and humidity control throughout, including raw material storage areas.

The West Coast, with its sporty and open-air-minded populace, has become a real stronghold for the reinforced plastics boat industry, centered near Costa Mesa, Calif. Glasspar Co., of nearby Santa Ana, is the volume-leader, having put 8000 boats in the water last year. The company's answer to the regional problem, like that of other large boat builders, has been the establishment of local plants in high sales areas, such as Olympia, Wash., and Nashville, Tenn.; a fourth big plant has just been opened in Petersburg, Va. Glasspar has three molds at each plant for its more popular models, and has been able to get at least three hulls a day out of each mold in two 8-hr. shifts.

Glasspar produces a total of 13 models between 10 and 19 ft., but 80% of its volume is in the 14- to 16-ft. outboard range. The company credits much of its success to design which takes full advantage of the unique properties of glass laminates, such as the use of curves not possible in other materials.

Another Costa Mesa firm, Wizard Boats, Inc., produced 3000 boats in 1957, including 39 hefty 26-ft. whale boats for the U. S. Navy. Wizard uses a 30- by 50-ft. heated curing room instead of a highly catalyzed resin. The resulting polyester pot-life of 24 hr. or more gives the boat maker plenty of time to lay up even the largest hull.

Like Glasspar, Wizard has regionalized its operation with two completely autonomous plants at Costa Mesa and St. Joseph, Mich., and is now building a new plant at Dixon, Tenn; the company, just as its neighboring competitor, wants a chunk of the lush Southern U. S. market.

Another West Coast firm—Dorsett Plastics Corp., Santa Clara, Calif.—is using isophthalic, a relatively new development, in its resins. This chemical, produced by Oronite Chemical Co., San Francisco, Calif., replaces the phthalic anhydride ingredient in conventional polyester resins. Oronite claims that isophthalic yields a laminate of greater flexural and impact strength, hardness, and durability. Dorsett uses the material in a line of attractive runabouts, including a 17-ft. cabin cruiser.

Bigger and bigger

Increasingly larger boats are being built of reinforced plastics. It is in boats of 25 ft. and larger that really important cost savings can be realized. Labor costs mount rapidly as the size of wood hulls increases; complex structural and stiffening members are needed to support them. With one-piece reinforced plastics construction, these members can be eliminated or replaced by molded-in or laid-in ribs and other reinforcements.

About two years ago the first 40-ft. plastics cabin boats were news; each new boat commanded attention. Now these big craft are rolling off assembly lines on a regular basis. Beetle Boat Co., New Bedford, Mass., manufacturer of tenders and sailboats, is currently working on orders for

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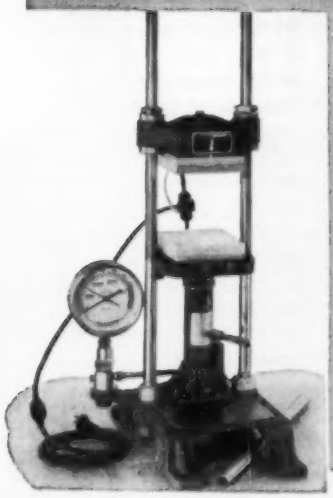
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ten of its 40-ft. Vitesse yawls. Ray Greene & Co., Toledo, Ohio, has also built several 40-ft. sailboats, although the bulk of the company's volume is made up of smaller two-man sailboats in the under 16-ft. class. Mr. Greene is one of the grand old salts of the fibrous-glass boat business: he was building (and earning patents on) plastics boats way back in the "prehistoric" era of 1946-48.

A 40-ft. racing sloop that quickens the pulses of yachtsmen everywhere is the *Bounty II*, manufactured by Coleman Boat and Plastics Co., Sausalito, Calif. This vessel at $24,000 is priced at perhaps 2/3 the cost of a comparable wood boat, and is reinforced plastics throughout, except for a 7500-lb. castiron keel bonded inside the shell. The design of the *Bounty* utilizes every functional part as a stiffening member; the reinforced plastics water tanks, for instance, also serve as hull stiffening members and floors for the cabin. The boat's deck is one huge reinforced plastic molding, and the mast is a 56-ft. giant tube of the same material which tapers from an 8-in. diameter at the bottom to 5 in. at the top. Since the *Bounty's* introduction a year ago, eight of the craft have been built, and the company has orders booked through its April production. Coleman's goal is to turn out a boat a week by next Spring. At first glance, this may not seem like big production by some standards, but it is for boats of this size.

For really "beefy" plastics boats, one has to look to the U. S. Navy.

A "small" LCVP of 36-ft. length, such as built in volume by Lunn Laminates, Huntington, N.Y. (see pictures, pp. 90-91), is almost an ocean liner compared to any pleasure craft, considering its weight of 16,500 lb., and hull thickness of 3 3/8 inches. Three inches of this thickness consist of resin-treated paper honeycomb, sandwiched between two skins of woven glass roving bonded with polyester resin. The hull is made in three sections which are cemented together with polyester. Lunn delivers

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A bank of three 50-ton capacity Dake Guided Platen Presses (above) used by TerraStone, Inc., Franklin Park, Illinois, to mold glass reinforced decorative panels.

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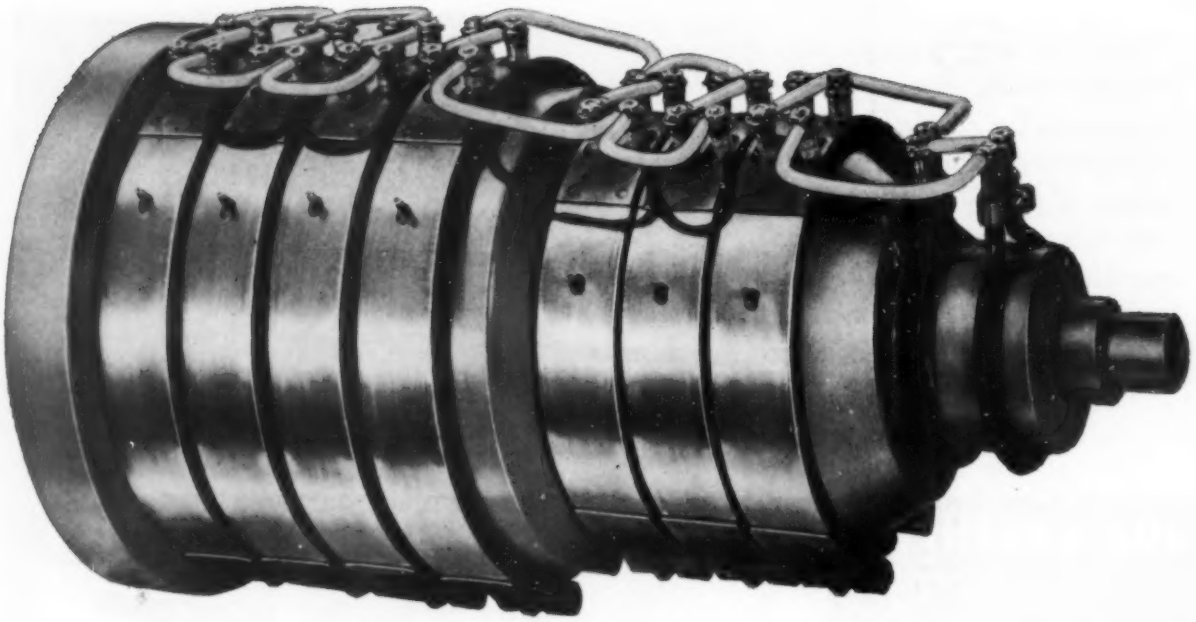

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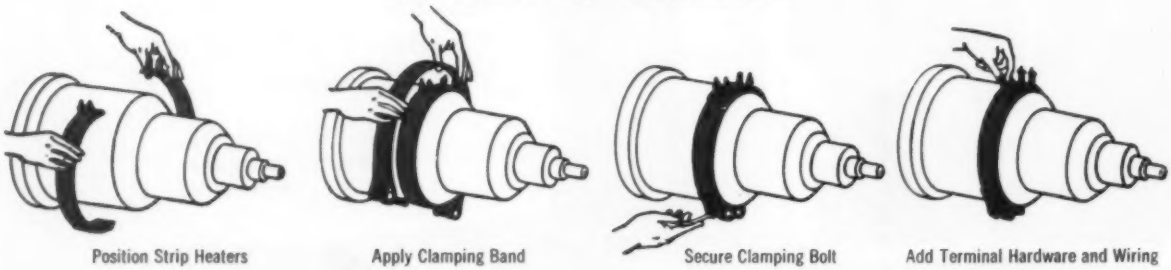
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The U. S. Navy has been a great backer of reinforced plastics boats from the beginning. A big attraction, in addition to low maintenance and good weatherability, is the fact that they are produced from non-critical materials.

Biggest customer

The Navy—biggest single customer for plastics boats—has been moving to larger and larger reinforced plastics craft, such as 40-ft. personnel and utility boats, 40-ft. LCPL's, and 50-ft. utility boats. The largest reinforced plastic vessel afloat—indeed the largest one-piece molding extant —is a 57-ft. minesweeper with a monolithic hull, and the Navy has completed exploratory work on ships of 80 to 100 feet. The service finds "no basic engineering limitations" to such large reinforced plastic vessels. It's just a matter of time.

New production process

A recent technical achievement that holds great interest for boat builders is a new three-nozzle gun that permits one worker to "sprayup" a hull on a mold with little more effort than spraying on paint.

The gun, which was developed by Rand Development Corp., Cleveland, Ohio, sprays measured amounts of chopped roving, resin, catalyst, and promoter onto the surface of a mold. Rand claims that the new gun takes 75% of labor cost out of the layup operation, and that the cured laminate has physical properties superior to most contact molded layups. The system also permits the use of chopped roving, which is less expensive than mat. Larson Boat Works, Little Falls, Minn.,



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has several of these guns in operation, producing a full line of boats from canoes to outboard cruisers. For details of this process, see "Reinforced plastics by 'sprayup,'" p. 119, this issue.

Another material and process that shows promise for boat construction has been developed by U. S. Rubber Co. The material involved is a laminate composed of a center core of cellular ABS plastic (Royalite), with skins of ABS. The process being used is thermoforming.

The company has already built a 14-ft. runabout with a one-piece hull (See picture, p. 94.) One of the great advantages is the forming method: in construction of a boat hull, the sheet is heated, then drape-formed to finished shape in a single operation. The deck and seats are also thermoformed. The boat weighs only 390 lb. and the integral cellular construction makes it virtually unsinkable.

U. S. Rubber built this 14-footer to demonstrate the worth of its new material and the feasibility of the ultra-simple forming method involved. The company does not intend to manufacture boats, but plans to build hulls, decks, and other major parts for customers who will then finish the boat.

The new Rand sprayup gun, with the inherent cost savings it offers, and the new U. S. Rubber foam laminate, which gets a thermoplastic into boat hull construction, both promise to tighten the unshakable hold which plastics have on the marine field.

But this battle is already won. The visionaries of the plastics industry are now setting their sights on the large commercial ships made of steel!

References

"Four ways of building plastic boats," by John B. Alfers, MODERN PLASTICS, *30*, 102 (Nov. 1952).

"Molding reinforced plastics," MODERN PLASTICS Encyclopedia Issue, September, 1957, p. 518.

"Latest landing craft," by John W. Marzicola, MODERN PLASTICS, *34*, 147 (March 1957).

"Big boat — no mold," MODERN PLASTICS, *33*, 104 (March 1956).

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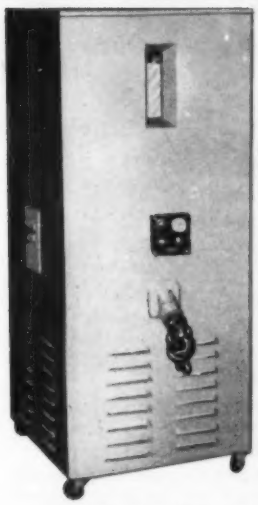


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Automated

(*From pp.* 104-107)

having a platen area measuring 48 by 94 inches. The press operator, after removing the two larger parts from the trim die, trips a lever which ejects the four small tail sections by air pressure. The frame-like part which remains after trimming out the sheet is slid into a receptacle for regrinding.

The Zeppelin halves are drawn slightly oversize, permitting them to be cut to an exact fit between the two sides. Two operators working at a table having a center partition and a circular saw mounted horizontally perform this finishing operation. One handles left hand parts, the other the right hand shells. Before trimming, the shells are seated firmly on reinforced plastics fixtures with acrylic sheet bases that are constructed so that a saw blade can enter the space between form and base. Resting on these fixtures, the shells are rotated horizontally against the saw blade, trimming the outer edge to the desired dimensions. Parts are then edge-wiped, inspected, and nested in containers for delivery to Hawk, where they are packaged with the injection molded parts.

When assembling the Zeppelin model, the two halves are joined by first cementing small tabs around the inner edge of one side, then bringing the halves together with a coating of cement between the butted edges. Rubber bands may be used to hold the parts together until the joint has hardened. Elevator sections are cemented together before these units are attached to the dirigible.

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Molding shrinkage

(*From pp. 125-136*)

trically to 230° F. prior to molding are plotted in Fig. 7 as X's instead of dots. Note that the principal effect of this preheating was to increase the effective cure of the part because, although molded for only 3 min., it has shrinkages comparable to those of a part given the normal 140° F. dielectric preheat previously described and cured for 4.5 minutes. The higher-temperature preheat probably did not advance the cure materially before molding but served principally to shorten the heating time and thereby increase the curing time.

It can be seen that the expansion of the material as shown by the difference between the upper two X's is less than that of the other parts as a result of loss of volatiles during preheating. Therefore, not all of the decrease in shrinkage of the high-temperature preheated part was due to increased effective cure; probably some decrease was the result of the volatile loss during preheating.

BM-120—Relationship between charge weight and shrinkage: The effect of increased charge weight and the corresponding increased molded-part weight on the molding shrinkage of parts molded in a landed mold is similar to the effect of increasing the pressure on the part. This may be seen by comparing Figs. 9 and 10, p. 135 The latter figure is based on parts molded at various pressures in a mold with the lands removed; hence it may be reasonably assumed that press loads were transmitted to the parts. A part having a 168-g. molded-part weight that was made in a landed mold had a diametral molding shrinkage of 0.008 in./in. (Fig. 9). By comparison, a part made in an unlanded mold at 600 p.s.i. has the same shrinkage (Fig. 10). From this it may be deduced that the pressure at the time of ejection in the landed mold was also about 600 p.s.i.; this value is of the same order of magnitude as that which was measured when an intermediate-charge weight was used in a similar mold(1).

The other effects shown in Fig. 9 parallel those for Diall 50-01 that appear in Fig. 6, particularly the large growth in the height direction that occurs at the high charge weights.

Heresite M-66-20: This material is an unfilled phenolic molding powder which had to be preheated dielectrically to 225° F. prior to molding in order to obtain transparent, void-free specimens. Figure 11, p. 136, shows the data obtained for parts molded of this material for 5 and 9 minutes. Note particularly the high diametral shrinkage and the high vertical growth. These effects may be attributed to the high expansion coefficient and high compressibility of the unfilled resin. The charge weight used was near the upper limit at which the mold would remain closed to lands during the molding cycle so that the molding shrinkage in the height direction was negative (i.e., the part grew).

Durez 16274: For this material,

shrinkages in height and diameter directions show only slight change with increase in molded-part weight (Fig. 12, p. 136). Compared with those in similar curves for BM-120 (Fig. 9), the changes in shrinkage do not nearly account for the difference in weight unless the part of lower weight is less dense. The specific gravities of the parts at 25° C., determined by accurately weighing them in air and water, definitely show that this is true. The part of lower weight had a specific gravity of 1.6477 compared with 1.7248 for the heavier part. The density in grams per cubic centimeter calculated from the weight, height, and diameter measurements was 1.6383 and 1.7234, respectively. These values are in good agreement with those above in view of the fact that the height was measured at only one point. Such measurements accurately reflect changes in part height (as in the cooling curves), but they are not precise measurements of mean part heights.

Figure 13, p. 136, shows cross sections of the two specimens which were put through the tests. The internal porosity that causes the part of lower effective charge weight to be of a lesser density can be quite easily seen in the photograph.

In the preparation of these parts, no attempt was made to select conditions intended to give void-free parts, such as dwelling, bumping, etc.; no preheat was used either, as it was for the other materials which are discussed above. If they are given only a visual inspection of their exterior, both of the specimens appeared equally well molded; these data therefore show the value of sectioning and examination of the interior of parts when unusual shrinkage components are encountered.

Acknowledgments

The authors would like to thank members of the Hughes Research and Development Laboratories for their assistance in this work, especially M. D. Hudson and C. C. Surland for their valuable advice and H. R. Boyles for his careful preparation of the test specimens.

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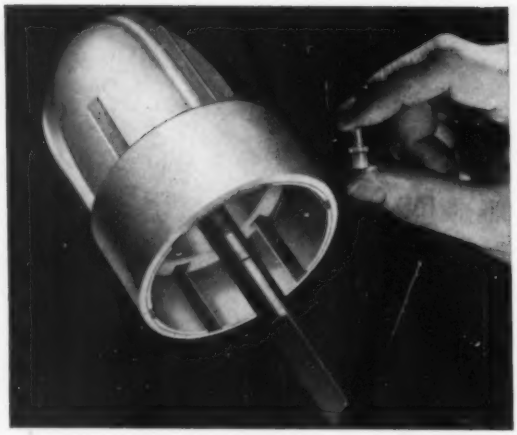
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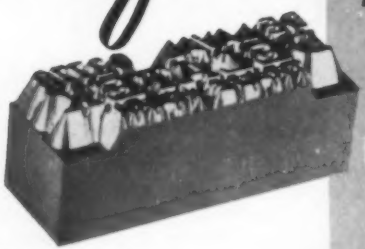
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'Formolding'

(*From pp. 137-140*)

of 200° F. when the blank was preheated to 356° F.

Pattern 2, which is similar to pattern 1 except that the grooves are vented, was molded successfully under the same molding conditions. A thickness variation in the sheet of 0.125 in. ±0.010 in. was not troublesome to achieve unless the change in thickness occurred over a short distance such as an inch or so. A uniform wedge-shaped sheet with the same amount of total thickness variation was also molded successfully, although some wedge shape remained in the final part.

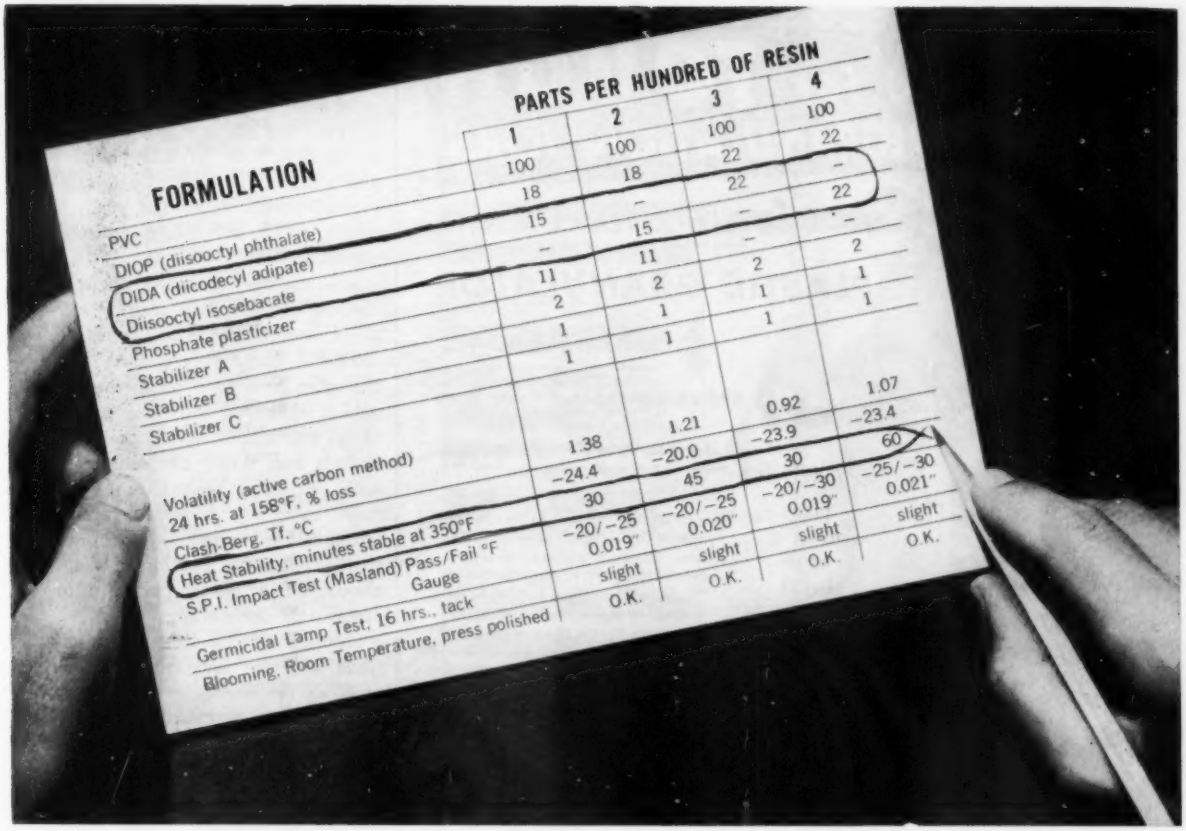
Pattern 3, which demanded less flow, was less critical to mold under the same molding conditions. Good parts were made except when the blank had excessive thickness variation.

When predried blanks were used, so that the sheet could be heated to 392° F., less pressure was needed than when the blanks were heated to lower temperatures. At a material temperature of 392° F., and a mold temperature of 200° F., both patterns 2 and 3 were molded successfully at 2400 p.s.i. on the material. A thickness variation of 0.125 in., ±0.015 in., caused no difficulty.

Molding conditions

A mold temperature of 200° F. or above gives best quality moldings. Substantially cooler molds make flow more difficult and may lead to crazing due to excessive stresses remaining in the part after molding. The molding tests on the mold patterns shown in Fig. 2 were all made at a mold temperature of 200° F.

With the types of molds used, 2400 p.s.i. was found to be the minimum pressure on the material for successful molding. This is much lower than the 5000 to 7000 p.s.i. which has been estimated to exist inside an injection mold during the filling portion of the molding cycle. However, the pressure needed for any specific formolding job will depend on the size, shape, and surface pattern of the mold as well as the mold and material temperatures and the sheet thickness.—END



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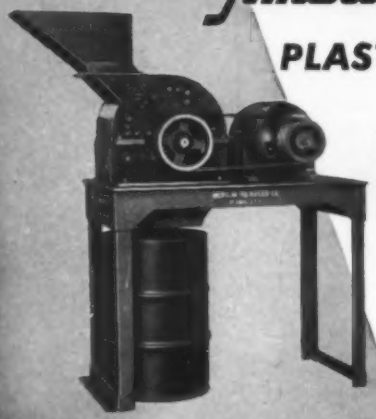
PHYSICAL PROPERTIES

Molecular weight	202.24
Combining weight	101.12
Density (80°C)	1.025 g/ml 8.55 #/gal
Melt viscosity (80°C)	78.5 centipoises
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Heat of vaporization (226°C)	107 cal/g
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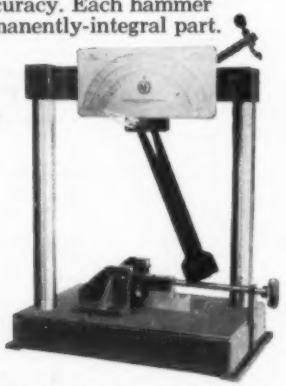
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Measurement

(*From pp.* 143-148)

used successfully in tests to determine the effect of cooling on a particular resin. In these tests it was subjected to rapidly changing temperatures as the resin in which it was imbedded was shock-cooled.

Information obtained through the use of the strain-sensing element serves important uses. A curve of force versus time tells the user how long after the reaction is started the resin begins to gel and shrink up on the tube. It tells him when the maximum force occurs and what its magnitude is. Also, a stress-versus-temperature curve, determined through thermal cycling of resin, shows effect of temperature on stresses in the casting.

Applied to different combinations of resin and catalyst, this method demonstrates how ambient curing temperature affects the maximum force exerted by a given mixture, and how different types and amounts of catalyst affect the length of time until maximum force is attained at a given curing temperature.

This information aids in the choice of that combination of resin and process that will produce the internal distribution most advantageous for a particular application. It can also be used to study annealing processes, with the object of securing optimum internal forces in the cured resin casting. Also, since internal stress is directly related to cure, this is an excellent method for determining degree of cure. Information thus gained is now being used to evaluate casting resin characteristics and thereby eliminate serious cracking which had been experienced in the manufacture of encapsulated electrical components (see "Evaluation of casting resins employing strain gage techniques," p. 150).

The author wishes to acknowledge that the basic work in this article was done by George Zibritosky of the Materials Engineering Department and Rupert Phipps, formerly of the Materials Engineering Department, Westinghouse Electric Corp.—END

Evaluation

(*From pp.* 150–153)

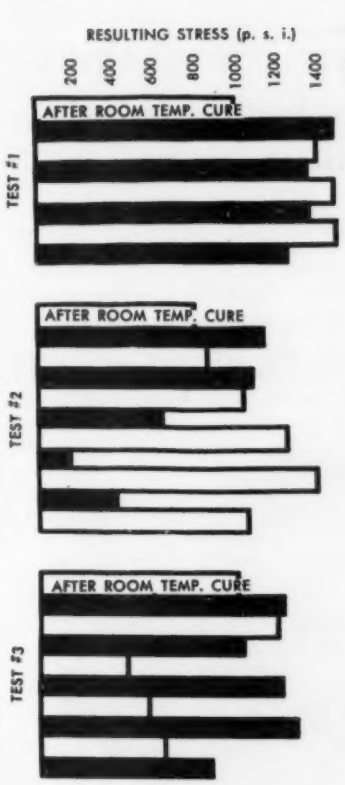
Figure 5, p. 153, illustrates the effects of two types of filler. Both casting formulations contain 50% of polyester resin and both fillers are 350 mesh. The calcium carbonate-filled castings have lower stresses than the mica-filled castings.

Usually the differences in stresses resulting from various fillers with any one particular resin are so small as to require a careful statistical study of the available data in order to obtain significant results.

Effect of the rate of cooling

For some time it has been suspected that the stresses in a casting resin can be altered by varying the rate of cooling or by heat-treating. A series of experiments was performed to determine the effect of cooling on a particular polyester resin casting formulation.

The results of these tests are shown in the bar graphs in Fig. 6. Three castings were made of the



	RESIN TEMP. AT THE TIME COOLING WAS STARTED, °C.	METHOD OF COOLING	TEMP. OF COOLING ENVIRONMENT
TEST #1	85	SLOWLY	ROOM
	85	SLOWLY	ROOM
	85	SLOWLY	ROOM
	85	SLOWLY	ROOM
	95	SLOWLY	ROOM
	85	SLOWLY	ROOM
	65	SLOWLY	ROOM
TEST #2	85	SLOWLY	ROOM
	85	WATER	30
	85	SLOWLY	ROOM
	70	WATER	10
	85	WATER	10
	85	SLOWLY	ROOM
	95	WATER	10
	85	SLOWLY	ROOM
	95	WATER	10
	65	SLOWLY	ROOM
TEST #3	85	SLOWLY	ROOM
	85	SLOWLY	ROOM
	60	COLD AIR	−25
	85	COLD AIR	−25
	85	SLOWLY	ROOM
	95	COLD AIR	−20
	85	SLOWLY	ROOM
	85	COLD AIR	−10
	65	SLOWLY	ROOM

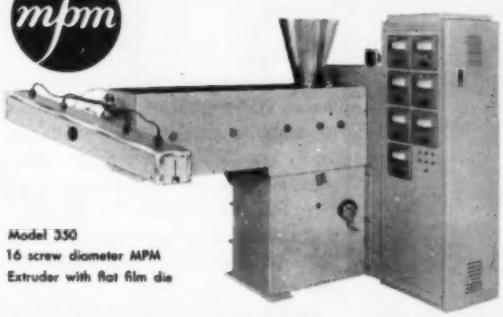
Fig. 6: Effect of rate of cooling on a specific polyester resin

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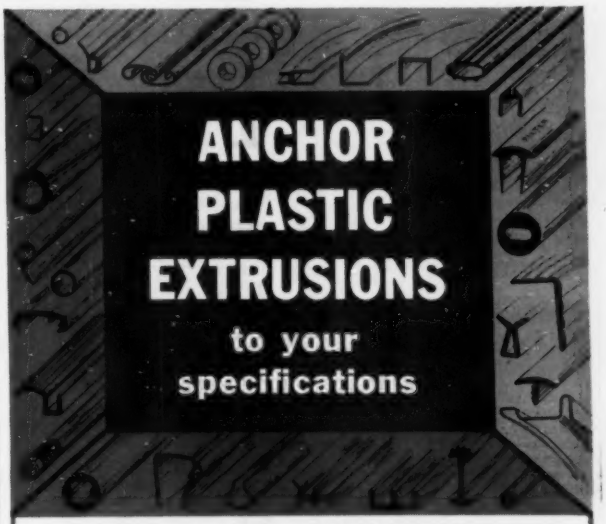
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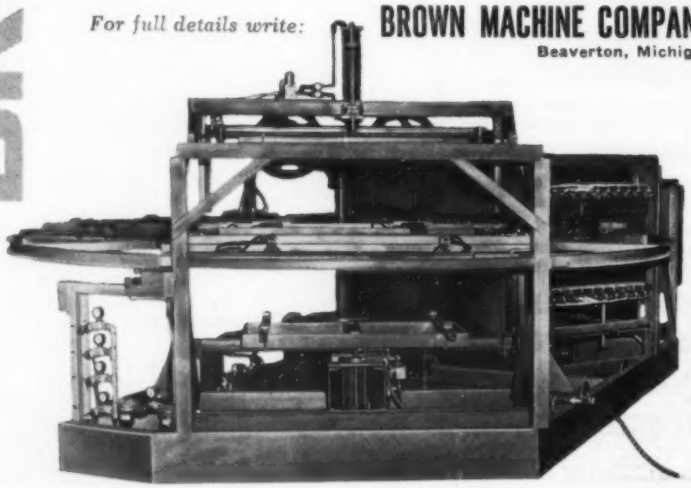
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same material. Casting 1 was heated rapidly to temperatures between 65 and 95° C. and was then cooled slowly to room temperature in an oven. Casting 2 was heated rapidly to temperatures between 65 and 95° C., and was then either cooled slowly or cooled quickly by quenching in water. Casting 3 was heated rapidly to temperatures between 65 and 95° C., and was then subjected to slow cooling either in the oven or to shock-cooling in cold air.

Examination of the bar graphs indicates that raising the temperature of a casting to 65 to 95° C. and cooling it slowly invariably removes all effects of previous heat treatment. Note, for example, test number two. When heated to 85° C. and cooled slowly to room temperature, the casting was under a stress of about 1100 p.s.i. However, when this same casting was reheated to 95° C. and shock-cooled in water at 10° C., the resultant stress was only 400 p.s.i. Subsequent slow reheating and cooling re-establish the original high stresses. These facts suggest that the resin system was being stress-relieved somewhere between 65 and 95° C.

The results that were obtained in this phase of the test program show that cooling conditions can be chosen that will shift the stresses around inside the casting and give a stress distribution that can better withstand thermal cycling.

Summary

Many types of casting resin systems can be evaluated. The effects of various catalysts, plasticizers, pigments, filler sizes, or other additives can be determined. Environmental effects such as temperature, water immersion, vibration, and humidity can also be studied.

In all, the strain gage test offers to the resin chemist and design engineer a new tool to predict the effects of compounding materials on the development of internal stresses of resin-embedded components and structures; and to the quality control engineer the strain gage test provides a method for establishing a control on raw materials.—END



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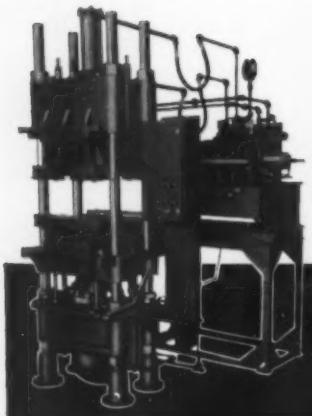
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Bis (aminophenyl)

(*From pp. 154-156*)

fone with iron and hydrochloric acid. Bis(3-amino-4-chlorophenyl)sulfone, m. p. 158 to 163° C., and bis(3-amino-4-methylphenyl)sulfone, m. p. 166° C., were similarly prepared from the corresponding nitro compounds. Bis-(4-aminophenyl)sulfone, m. p. 174.5 to 176° C., was obtained by the reaction of 100 g. bis(4-chlorophenyl)sulfone with 5 g. cuprous chloride, 2.5 g. copper powder, and 1000 ml. of 64% ammonium hydroxide in an autoclave at 200 to 213° C. for 40 hours. The crude product was filtered and purified by dissolving it in 10% hydrochloric acid, filtering the solution, precipitating the product with NH_4OH, and recrystallizing it from aqueous ethanol.

Relative basicities of the compounds in Table I were estimated by potentiometric titration of the amines with 0.1 N perchloric acid in glacial acetic acid (Fritz, Analytical Chemistry *22*, 1028 [1950]). A small amount of acetic anhydride was added to the reagent, since it was found that satisfactory titration curves were obtained only under strictly anhydrous conditions. The titrations were carried out with a Beckman Model G pH meter, using a glass electrode and a saturated calomel electrode.

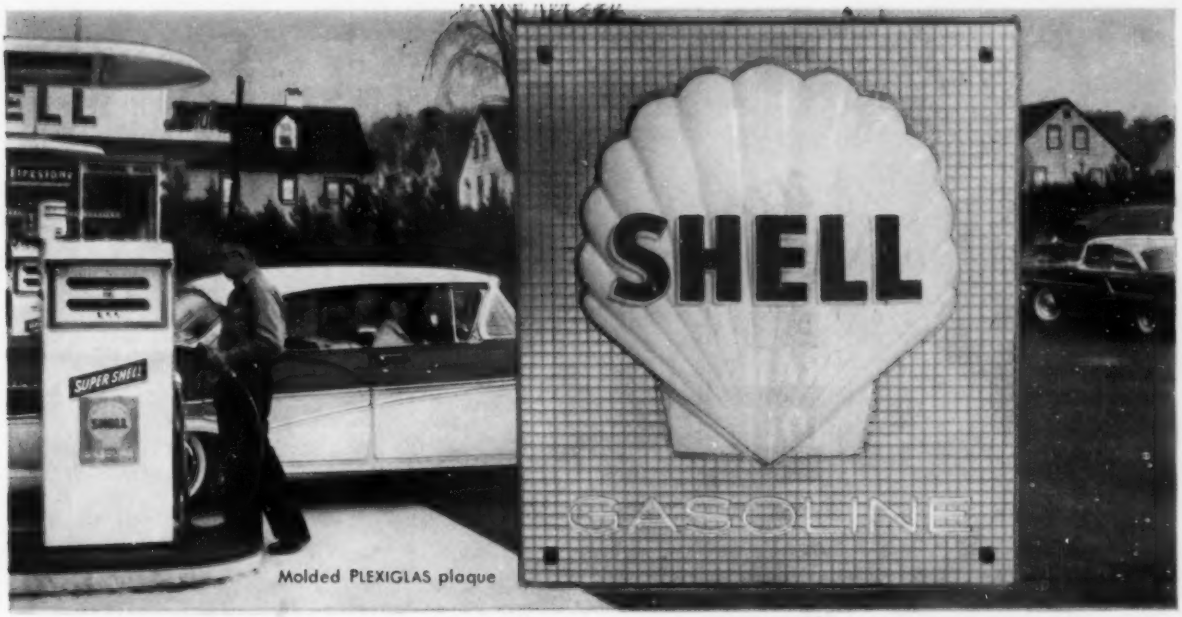
Each neutralization curve showed only a single equivalence point. The potential at half-neutralization was obtained from the curve. The estimated precision of measurement was 10 millivolts. Relative basicity values were then calculated from the inverse of this potential, taking the value for ethylenediamine as 100.

The pot life of the mixture of Epon 828 and curing agent was estimated by placing 10 g. of the mixture in an oven at 60° C. and measuring the length of time required for the mixture to set to a firm gel.

Flexural strength measurements shown in Table II on the cured resin castings were made by A.S.T.M. Method D 790-49T, using a specimen 0.5 by 0.5 by 5 inches. The strength measurements given in Fig. 1 were obtained by a modified procedure, which had to be used in initial work because of the small amount of material available for study. In this procedure, a cured resin specimen 0.25 by 0.25 by 2 in. was loaded as a simple beam, having a span length of 1.25 in., in a Dillon Model L Universal Tester. The force required to break the specimen was measured. Each value shown represents the average of at least 5 determinations. Standard deviation was estimated at 4,000 p.s.i.

Heat-distortion temperatures were measured by A.S.T.M. Method D 648-45T, using specimens 0.5 by 0.5 by 5 inches.

Part of the work described in this paper was carried out at Southern Research Institute under the sponsorship of the Tennessee Corporation. The bis-(aminophenyl)sulfones were prepared by T. W. Sauls and S. L. Norwood. J. W. Murphy and Mary Jane Montesinos assisted in the laboratory work.—End



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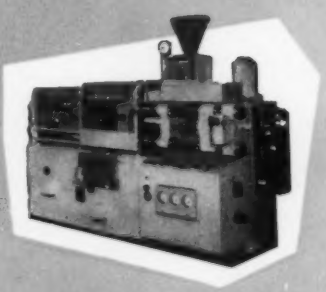


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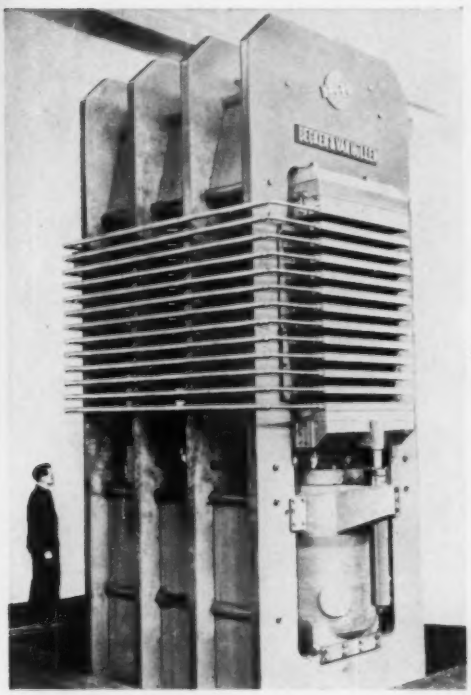
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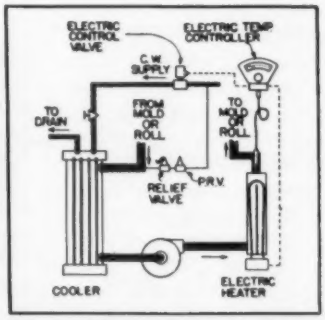
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The Plastiscope

News and interpretations of the news
By R. L. Van Boskirk

Section 2 *(Section 1 starts on p. 35)*

Vinyl film meeting–1957

Subjects not on the agenda probably received more attention at the December film meeting than the papers which were read, even though the latter often related to topics of great interest. Two papers in particular—the one on laminating and the discussion on practicality of extrusion versus calendering—deserve special commendation, but the subjects are heavy and require careful study. The "gossipy" subjects are much easier to talk about and that's what those at the meeting were chewing over in the halls and smoke-filled rooms after the usual customer-supplier conversations were concluded.

Prices and profits were the main topic of concern in these confabs. There seems no question that vinyl film and sheeting volume was considerably more in 1957 than in 1956, but practically everybody complained of a serious decline in profits.

There was some cheer in mid-December when it was reported that the so-called independents had raised their 43-45¢/lb. price range to a 45-50¢ range, depending on quantity and specialties. But there is still some question as to whether or not that range has become firm.

There are two groups of producers in the industry, with one group generally maintaining a higher price level, which in 1957 was in the range of 49-54 cents. In 1956, prices were 2¢/lb. higher over the entire industry but weakened in 1957. The attempt to raise prices in December was a surprise development since December is usually a low-sales month and an upward price trend has never before developed at that time of year. At any rate, the price situation in vinyl film and sheet is serious and there are no visible signs that it is going to improve enough to help the profit position in the near future.

Another tender price spot in the industry is plasticizers. Volume is high, but as long as the supply of DOP and DIOP is so much greater than demand, the plasticizer industry is apparently doomed to a dog-eat-dog situation. Perhaps the biggest mystery in plastics today is: How can so many people afford to stay in the plasticizer business?

Another mystery: How will the growing number of producers now manufacturing resin as well as film fare in the future? Nearly all film calendering firms are tied up somehow with either a resin producer, or they make their own. So far this situation has not helped either profits or quality. And since most of the new resin-to-film producers have surplus resin to sell, their impact on the entire vinyl industry is of considerable import. The vinyl industry is certainly due to continue its growth and the competitive position of these comparatively new producers is going to be watched closely. Will they grow? Will there be more like them? Will the industry find that only big-volume resin plants can be operated at a profit?

Those who came to the meeting for marketing information didn't get many hard and cold facts, but they listened to some interesting ideas. Most factual was the paper on unplasticized calendered vinyl by A. J. Baldwin of Nixon Nitration Works, who stated that the market consumed 15 to 20 million lb. of sheet in 1957 but is presently limited because thickness range is only from 0.005 to 0.040 in.; because surface is limited to a matte finish; and because of residual strain. The latter problems can be solved by press polishing, but that adds cost. Calendered material amounts to only 15 to 20% of the entire rigid or unplasticized vinyl market. However, Mr. Baldwin predicted that the market will increase many-fold in the next five years if resins are made available with improved stability, better high- and low-temperature properties, and resistance to ultra-violet light.

He listed prices of unplasticized vinyl calendered sheet at $0.089/sq. ft., compared with modified styrene at $0.065, cellulose acetate at $0.125, and butyrate at $0.136.

Business machine cards, such as credit cards used by oil companies and "charge-a-plates," will soon blossom into a big market for rigid vinyl, said Mr. Baldwin, and he seemed particularly optimistic about increasing volume for vinyl electrotyping molds.

Vinyl in aircraft. Danforth Cardozo, Jr., from Walter Darwin Teague Associates, told of the use of vinyl sheeting in the new Boeing 707 jet airliner. The interior linings are mostly vinyl-aluminum laminates, but vinyl on a honeycomb, vinyl over a foam bumper on the hat rack nosings, vinyl film laminates over vertical bulkheads, and film laminated to stainless steel in the galley sidewalls are other uses. There has also been a change to light pastel colors, but operators of airlines want almost unbelievable variety. The speaker didn't mention the size of the market, which is still comparatively small.

On railroads. W. W. Patchell, a research and development man of the Pennsylvania Railroad, talked more about "all plastics" than vinyl but claimed that the use of plastics would increase the life of car exteriors by 300 percent.

Those who came for technical

•Reg. U.S. Pat. Off.

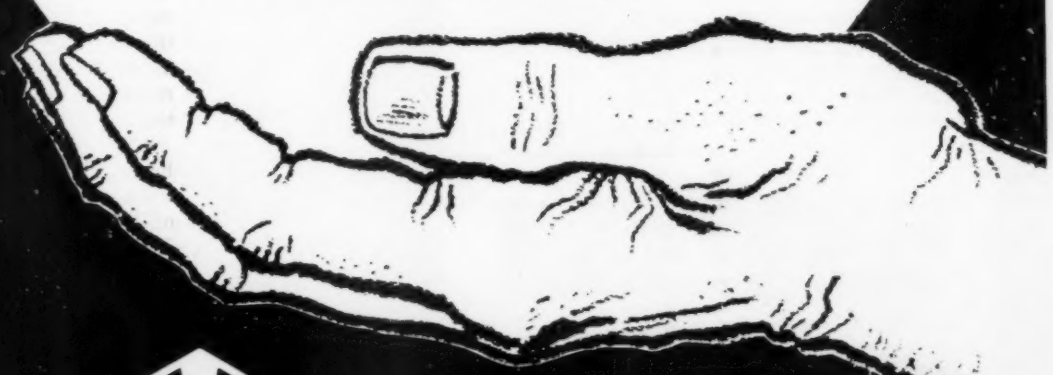
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information heard Albert A. Kaufman and Frank R. Nissel of Prodex Corp. give their opinion on how and why extruded vinyl will cut a big swath in the calendered vinyl field in the next five years.

Roy W. Ritchie, vice president of Rich-Tex, Inc., Cedar Grove, N. J., gave a detailed description of the various lamination methods used in joining vinyl film or sheet to itself and various other materials.

An apparatus for the study of dielectric heat sealability of films and the possibility of operating calenders with a separate motor for each calender roll were also meat for the technicians, but some of them left the meeting shaking their heads at the idea of adding more complicating factors to the already complex task of operating a monster calender, with each roll a subject of individual attention.

Reinforced plastics growth

Sales of reinforced plastics reached the 168 million-lb. level in 1957, a 20% increase over 1956, according to a market study conducted by the Reinforced Plastics Div. of The Society of the Plastics Industry, Inc. Another increase of 20% is expected in 1958 by three-fourths of those companies reporting to S.P.I., but the other members expect only a 10 to 15% increase.

Of the 168 million lb. reported, resins account for 84 million lb.; reinforcement, filler, pigment, etc. for the balance. The polyester resin total is estimated at 78 million lb., but this figure apparently includes some resins for compression and injection molding as well as for laminating; the plastics industry as a whole generally considers only laminates and lay-up molding as part of the reinforced plastics group. If all reinforced molding material is included, the figure would be much larger, for filled phenolics, melamine, urea, alkyds, and many impact-type resins could be counted.

Obviously, some kind of a definition is needed to delineate just what is meant by reinforced plastics. What, for example, would be the classification of high-pressure phenolic and melamine laminates which apparently are not in the S.P.I. report?

Another question might be: why are polyester-sand and polyester-glass coatings for concrete block listed as reinforcing resins when they are used primarily as a protective coating material?

However, the Reinforced Plastics Div. is out to show that its industry is going places and it is justly proud of its progress after years of struggle. There may be confusion about the group's statistics, but there isn't much doubt about its progress in the development of products that can use fibrous glass-reinforced polyester or epoxy materials. And recent reports indicate that phenolic resin, too, is receiving more acceptance than formerly, especially in the missile program where higher heat resistance is sorely needed.

Table I is a record of what the industry has accomplished in the last two years.

Transportation use appears to be the largest use, with about half of it automotive timing gears. The balance is used for truck and trailer bodies; bus seats; railroad passenger car seats, berths, and bathrooms; freight and refrigerator cars; and the Chevrolet Corvette.

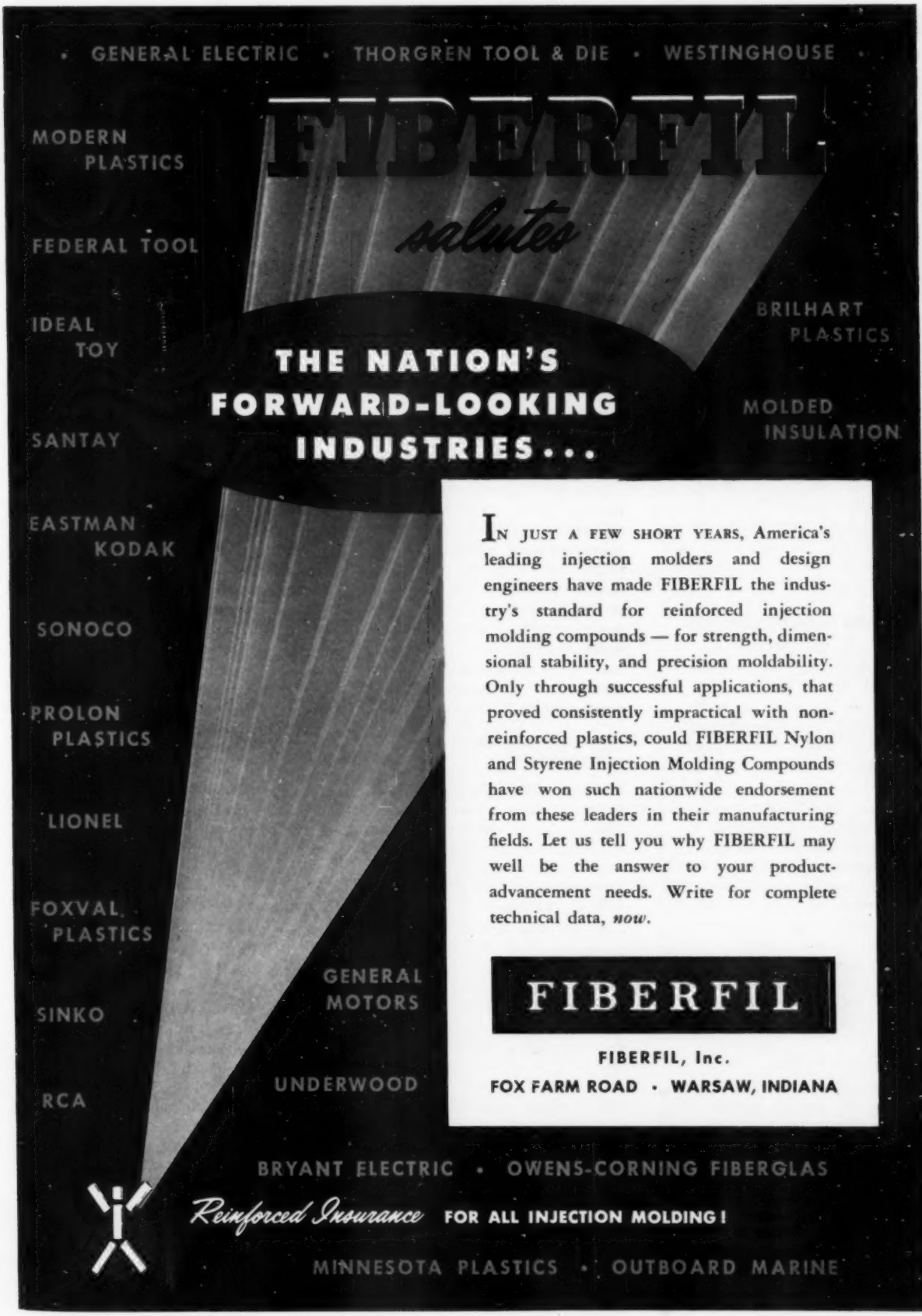
Boats produced from fibrous glass-reinforced plastics are now well established and should continue at a steady growth. Between 45,000 and 50,000 new craft were made in 1957 and they account for about half of the 25 million lb.; in the table the remainder was used in the covering of wooden boat hulls, deck surfaces, and other protective surfacing. (No attempt can be made as yet to reconcile the above estimate on the number of boats made in 1957 with that given on p. 87 in the article "Plastics Ahoy!"—*Ed.*)

Biggest single use of reinforced plastics is thought to be for flat and corrugated paneling, with a 45 to 50 million-sq. ft. output in 1957. Less than half of that amount was residential, which indicates that a large potential remains. Most other building uses such as sandwich panels are still in the developmental state.

Consumer products showed a tremendous poundage increase in 1957 over 1956. Partly account-

Table I: Progress of reinforced plastics

Major markets	*Percent of 1957 industry volume*	*Estimated 1957 poundage*	*1956 Poundage in round figures*
	%	lb.	lb.
Aircraft and missiles	15	25,200,000	28,000,000
Appliances	3	5,040,000	7,000,000
Boats	15	25,200,000	22,400,000
Construction	15	25,200,000	22,400,000
Consumer products	15	25,200,000	14,000,000
Containers and trays	3	5,040,000 (excluding tanks and ducts)	7,000,000 (including tanks and ducts)
Electrical	3	5,040,000	(Included in Miscell.)
Pipe, tanks, ducts	2	3,360,000	(Included in containers and Miscell.)
Transportation	20	33,600,000 (including premix and molding material)	11,200,000 (excluding premix and molding material which is in Miscell.)
Miscellaneous	9	15,120,000	28,000,000


• GENERAL ELECTRIC • THORGREN TOOL & DIE • WESTINGHOUSE •
MODERN PLASTICS
FEDERAL TOOL
IDEAL TOY
SANTAY
EASTMAN KODAK
SONOCO
PROLON PLASTICS
LIONEL
FOXVAL PLASTICS
SINKO
RCA
FIBERFIL
salutes
BRILHART PLASTICS
MOLDED INSULATION
THE NATION'S FORWARD-LOOKING INDUSTRIES...
GENERAL MOTORS
UNDERWOOD
IN JUST A FEW SHORT YEARS, America's leading injection molders and design engineers have made FIBERFIL the industry's standard for reinforced injection molding compounds — for strength, dimensional stability, and precision moldability. Only through successful applications, that proved consistently impractical with non-reinforced plastics, could FIBERFIL Nylon and Styrene Injection Molding Compounds have won such nationwide endorsement from these leaders in their manufacturing fields. Let us tell you why FIBERFIL may well be the answer to your product-advancement needs. Write for complete technical data, now.
FIBERFIL
FIBERFIL, Inc.
FOX FARM ROAD • WARSAW, INDIANA
BRYANT ELECTRIC • OWENS-CORNING FIBERGLAS
Reinforced Insurance FOR ALL INJECTION MOLDING!
MINNESOTA PLASTICS • OUTBOARD MARINE

The Plastiscope

able was the increase in outboard motor housings and furniture. Fibrous glass-polyester fishing rods now account for 95% of the market; at 7 oz. per rod and with sales of close to 5½ million units a year, this represents a poundage of 2½ million pounds.

Perhaps the most significant paragraph in the S.P.I. report is that devoted to production technique which calls attention to a rotary preformer which can produce as many as 80 to 90 safety helmet preforms or 70 chair preforms per hour. Any equipment that can speed up fabrication of reinforced plastics products is a most welcome factor to an industry that is bedeviled with comparatively slow production techniques.

To make polyethylene yarn

Entry into the polyethylene yarn field has been announced by United States Rubber Co. The yarn will be produced at Providence, R. I., in a plant of the firm's Footwear and General Products Div. The Textile Div. will be responsible for sales from headquarters at 1230 Avenue of the Americas, New York 20, N. Y.

The combination of low cost, high tensile strength, good chemical and heat resistance, and other properties of the material has made polyethylene yarns attractive to manufacturers of automobile seat covers, outdoor furniture, industrial filters, venetian blind tapes and cords, shoe fabrics, etc.

Dry film adhesive

A new adhesive film for bonding flat metal sheets, flexible films to metal and other plastics, and metal and plastic skins to honeycomb cores has been added to its line of film-type adhesives by Rubber & Asbestos Corp., 225 Belleville Ave., Bloomfield, N. J.

The firm's new film adhesive, Plymaster V-3, is an elastomeric-phenolic, 4 mil thick, 100% reactive synthetic rubber-resin which incorporates a high-strength, porous paper as the carrier for the adhesive. At 70¢/yd., it is claimed to be lower in price than previously reported products of this type.

Flameproofing compounds

Brominated compounds, used to impart flameproofing and self-extinguishing characteristics to plastics, protective coatings, fluids, textiles, paper, and wood products, have been announced by Michigan Chemical Corp., St. Louis, Mich. The products are tetrabromobisphenol-A, tetrabromophthalic anhydride, tris (2-bromoethyl) phosphate, pentabromophenol, and tris (2,3-dibromopropyl) phosphate.

The possibility of brominating curing agents, monomers, and basic resins themselves to achieve a "built-in" flameproofness is a related phase of research and development being carried on by the company.

Polypropylene laboratory equipment

Beakers, centrifuge tubes, graduated cylinders, and other laboratory items produced from Hercules' polypropylene have been placed on the market by The Nalge Co., Inc., 625 S. Goodman St., Rochester 20, N. Y. The company asserts that a softening temperature of 340° F. was one of the reasons why the material was selected for use in laboratory ware. In addition, the clarity is so good that newsprint can be read through a section ⅛ in. or more in thickness. Nalge also states that its tensile strength is two to three times that of linear polyethylene.

Dusseldorf Trade Fair

The international trade fair, "Plastics 1959," will be held in Düsseldorf, Germany, from October 17 to October 25, 1959. International participation, which was formerly restricted to the machinery and accessories industries, will also include the plastics producing and plastics processing industries.

The fair will be organized by The German Plastics Federation, Frankfurt/Main, in cooperation with the Association of Manufacturers of Machinery for Processing Rubber and Plastics, Hannover, and the Association of Manufacturers of Cutting and Punching Tools and Tools for Plastics Processing, Frankfurt/Main.

The technical organization of the fair is in the hands of Nordwestdeutsche Ausstellungs-Gesellschaft mbH. (NOWEA), Düsseldorf, Ehrenhof 4, Germany.

New company for compounds

Gold-Mark Plastic Compounds, Inc., 4-05 26th Ave., Long Island City 2, N. Y., has been formed to serve the domestic and foreign markets of the plastics industry with thermoplastic compounds, such as polyethylene, acetate, polystyrene, PVC, etc. The company will engage in custom compounding and will purchase and sell surplus plastics stocks.

Officers of the firm, all formerly with American Molding Powder & Chemical Corp. and A. Bamberger Corp., are as follows: Herbert H. Goldmark, president and general manager; George W. Weir, vice president and director of purchases; and Kenneth Gross, vice president and sales manager.

More epoxy—less polyester

A new liquid epoxy resin plant with a 15 million-lb. annual capacity will be put into commercial operation early in 1959 at Marietta, Ohio, by Union Carbide Corp. Sales and technical services will be handled by Bakelite Co. Among the broadening markets expected to help consume the additional epoxies are reinforced epoxy pipe for the petroleum industry and laminated epoxy structures for the automotive and aircraft industries. Increased use is expected in such well established fields as tools and dies, encapsulating, solders, and adhesives.

Shortly after the above announcement, Bakelite announced

U.S.I.
Vol. III No. 1

POLYETHYLENE PROCESSING TIPS

PROCESSING CONDITIONS AFFECT STRESS-CRACK RESISTANCE OF POLYETHYLENE PRODUCTS

Most thermoplastic materials are subject in varying degrees to environmental stress-cracking . . . and polyethylene is no exception. Stress-crack failures may occur in polyethylene when the plastic is under high local stresses, either externally or internally applied, and in contact with soap, detergent or solvent.

Stress crack resistance depends on the resin used, and the processing conditions. The effect of polyethylene resin properties were discussed in the last issue of TIPS. This issue will be devoted to the effect of processing conditions.

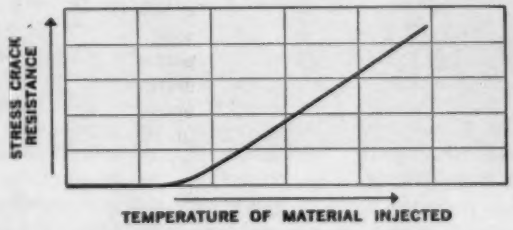
Apart from outside forces, there are, for a given polyethylene resin, two main causes of stress-cracking: locked-in stresses, and a high degree of molecular orientation. Locked-in stresses arise from uneven shrinkage during cooling. In molecular orientation, polyethylene molecules are comparable to iron filings in a magnetic field; they line up in force or stress patterns which, in effect, are stress concentrations along which fractures may occur.

Mold design affects stress cracking

To improve the stress-crack resistance of molded polyethylene, the molder should select his resin carefully on the basis of mold design, injection and mold temperatures, and, of course, the properties he wants in his end product.

Here, for example, is one way in which mold design can influence the choice of a resin: It is *generally* true that resins of higher molecular weight have relatively high stress-crack resistance. But in deep-draw molded items, or those with large cross-sections, resins of low molecular weight often yield a product with better stress-crack properties. This is because resins of low molecular weight—and hence, lower viscosity—permit the mold to fill more quickly. Under these conditions the material cools at a more uniform rate and fewer internal stresses are created.

Different flow rates, due to abrupt changes in mold cross-section or to sharp corners, may create points of stress concentration. These cannot always be eliminated, since every design is a compromise between mold engineering and product design.

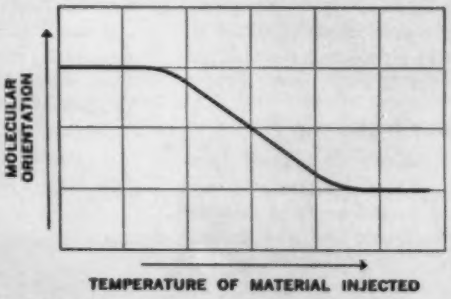


Stress crack resistance increases with higher stock temperatures in injection molding.

How Cold the Mold?

Higher production rates, made possible by running a cold mold, may be offset by a high incidence of stress-crack failures due to molecular orientation. This difficulty may be minimized by using a resin with the right flow properties—always bearing in mind that a practical compromise must be made with other desired end properties. Molecular orientation occurs when the hot resin comes in contact with the relatively cool walls of the mold. The outer surface of the stream cools faster than the interior and tends to slow down, while the material nearer the center flows unimpeded. The molecules tend to line up in the direction of flow.

This difference in cooling rates between the material at the periphery of the stream and its center also sets up internal stresses which induce stress-crack failures.



Molecular orientation is decreased with higher stock temperatures.

Mold Release Agents have some effect

Mold release agents may be of some benefit, as they tend to reduce the "drag" effect. However, caution must be used in their selection, since certain materials may induce stress cracking.

Compromise is often necessary

While no simple answer exists to the problem of stress-cracking in polyethylene products, resistance can usually be brought to a satisfactory level by choosing the best resin, making adjustments in molding temperatures, cooling rates and mold design. Since certain compromises must always be made, in selecting a resin and in processing techniques, processors can frequently use the services of a resin specialist. U.S.I.'s Technical Service Engineers are ready to discuss your processing problems, and to help in every way to solve them.

U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corp.
99 Park Ave., New York 16, N.Y.
Branches in principal cities

The Plastiscope

the company's withdrawal from the manufacture of polyester resins but emphasized continued interest in reinforced plastics through its activity in the manufacture of epoxy and phenolic resin for that field.

NP-10 polymeric plasticizer

Due to an error, the price of Eastman Chemical Co.'s NP-10 polymeric plasticizer was reported in this column in October as selling for 37¢ a pound. The correct price is 50¢ a pound. The 37¢ price was for neopentyl glycol, one of the materials from which NP-10 is produced.

Eastman has recently completed full-scale production facilities for neopentyl glycol and reduced the price from 45 to 37 cents.

Sponsors fellowship

Foster Grant Co., Inc., Leominster, Mass., plastics and chemical producer, is sponsoring a fellowship at the Polytechnic Institute of Brooklyn for a graduate student from the Leominster area.

The fellowship, which covers a $2000 stipend, tuition, and costs of materials and supplies required, will be given to a student who is a child or close relative of a Foster Grant employee. Lacking such a candidate, preference will be given to a resident of Leominster.

Acrylic on the move

Corrugated, extruded methacrylate sheet, lower in cost than cast sheet but equal in optical, weathering, and chemical properties, is being offered by Cadillac Plastic & Chemical Co., Detroit, Mich. The sheets are expected to find application in sign facings and displays, office partitions, greenhouses, and other glazing applications where the extra rigidity of corrugation is a factor.

Standard widths of 35½ in. are provided with interlocking edges so that the sheets may be linked up to any desired widths without a break in the pattern of corrugations. Standard lengths stocked at the firm's warehouses are 36, 48, 72, and 96 in.; lengths up to 25 ft. are furnished on special order. Standard colors are white in two degrees of translucency; other colors may be obtained on special order.

The company also announces that production of its Cadco cast acrylic rods and tubes has been placed on a three-shift, seven-day basis and the warehouses will carry limited stocks in the most popular sizes.

New vice presidents

Marvell A. Olsen and James M. Connors have been elected vice presidents of Breskin Publications, New York, publishers of MODERN PLASTICS and *Modern Packaging* Magazines. Mr. Olsen, who joined the organization in 1935 as a sales representative,



M. A. Olsen



J. M. Connors

was named general manager of the firm earlier this year and will continue to hold this position. As vice president for Western operations, Mr. Connors will remain in charge of the firm's Chicago office, a post he has held since joining the Breskin organization in 1938.

Vinyl plastisol compounds

A series of vinyl plastisol printing plate compounds in various colors and of five different Durometers has been introduced by Dennis Chemical Co., 2701 Papin St., St. Louis 3, Mo. The compounds, named Denflex, are said to possess good molding qualities; sharp, clear details (including half-tones); the ability to withstand many times the number of impressions of rubber; and complete release of inks.

They have been used successfully by rubber printing plate engravers, rubber stamp manufacturers, and producers of printing, impression, and feed rollers.

Extrudes 75-in. sheet

Kal Plastics, Inc., Beaverton, Mich., has put into operation a 75-in. wide sheet extruder which has a maximum plastics output of 450 lb./hour. The company is presently running Dow high-impact polystyrene and polyethylene through the machine, and output for the latter is reported as between 400 and 420 lb./hour.

It is believed that the sheet is the widest available in the 40-gage-plus thicknesses. According to the company, tolerances of ±0.001 can be maintained for sheet from 0.010 to 0.250 in. thick.

The 75-in. sheet is sold as roll stock up to 60 gage and thicker material comes as cut stock 72 in. wide and of specified lengths. The company believes that the polystyrene will find use as automobile head liners and perhaps as vacuum formed scenery for television and motion picture sets, whereas polyethylene sheet may have application as welded-seam tank linings and as vapor barriers in construction work.

The 12- to 20-gage material which the firm plans to produce is expected to be more durable and tear resistant in cold weather than the 4- to 8-gage film now commonly used.

The extruder was modified in cooperation with Brown Machine Co., Beaverton.

Visking distributor named

Commercial Plastics & Supply Corp., New York, N.Y., has been appointed a distributor of the full line of polyethylene film manufactured by Visking Corp., Chicago, Ill. Commercial expects to gross a minimum of $250,000 in the next 18 months on this material alone. The company intends to pursue all the young large-scale markets that are opening for polyethylene film—outdoor construction, industrial tarpaulins, laundry and dry cleaning establishments, etc. The firm has been stocking polyethylene film

From the Dow family of plastics... look to

Tyril

with its excellent balance of properties

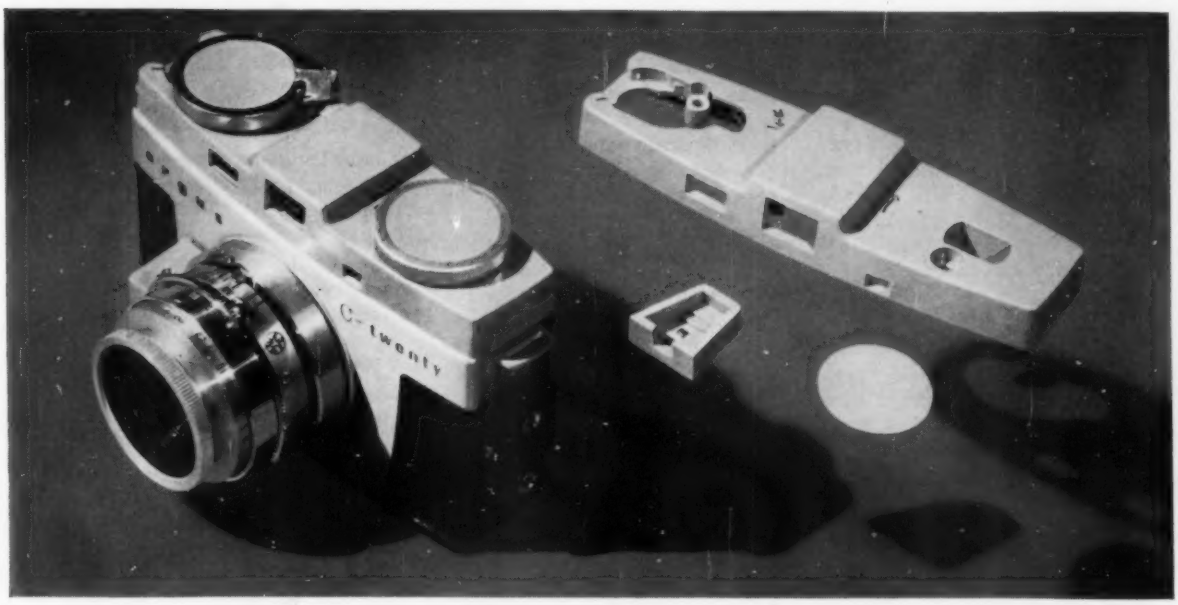


If the finished product calls for good over-all balance of properties, chances are Tyril* is the material you need. You see, this amazing new Dow thermoplastic, a styrene-acrylonitrile copolymer, has already *proved* its merits.

This camera is just one of the dozens of fast-selling items that feature components made of Tyril. Its manufacturer specified molded parts that would look good, take abuse, resist heat and be light in weight. Tyril provided all these critical properties and *then* some. Its high gloss finish and wide range of colors assured built-in sales appeal. Its exceptional craze resistance added long life to the parts. And from the fabrication standpoint, easily molded Tyril proves more economical than competitive materials.

Quality materials, prompt shipments and expert technical service are included in the price of every member of the Dow family of thermoplastics. Shouldn't you get in touch with your Dow man soon? THE DOW CHEMICAL COMPANY, Midland, Michigan, Plastics Sales Department 1612A.

*Trademark of The Dow Chemical Company



From camera components to closures—

Dow plastics lead the way

DOW

TYRIL* · STYRON* · ETHOCEL* · SARAN · POLYETHYLENE · PVC RESINS

The Plastiscope

for about three years, but chiefly as a convenience item for its customers; the new deal will result in the first intensive sales effort by the company for this material.

Commercial Plastics now claims to maintain the largest stock in the East of plastics sheets, rods, and tubes and to service over 20,000 customers, of which 7000 or 8000 are active accounts. The firm now grosses more than $4 million a year, of which $2 million is done out of the 30,000-sq. ft. New York branch. The company's other branches are in Newark, Pittsburgh, and Miami.

New York Rubber Group

A fifteen lecture course in Advanced Elastomer Technology, to be held at the Engineering Societies Building, 29 W. 39th St., New York, N. Y., beginning February 18, has been announced by the New York Rubber Group. Among the lecturers who will discuss high polymer chemistry are Dr. William Slichter, Dr. H. Mark, Dr. A. M. Bueche, Dr. John A. Davison, and Dr. Turner Alfrey, Jr.

Non-members may obtain registration forms from L. C. Komar, Titanium Pigment Corp., 99 Hudson St., New York 13, N. Y. Registration fee for members is $25 and $28 for non-members.

Resin for plasticizer

Bearflex 1751 is the name of a new hydrocarbon plasticizer resin produced by the Chemical Div. of Golden Bear Oil Co., 325 W. Eighth St., Los Angeles 14, Calif.

Company literature asserts that a blend of 70% Bearflex and 30% DOP gives a plasticizer system compatible with PVC resin and is suggested for all types of vinyl compounds.

Development group

Larkin Associates, Inc., Huntington Station, N. Y., is a new company offering its services to the aircraft-missile, plastics, and chemical industries. The firm will do research and development in such areas as reinforced plastics, metal-to-metal and honeycomb bonding, plastics tooling, chemical milling, sealants, and encapsulation of electronic components. Larkin is reported to have a thorough knowledge of applicable military specifications and contract negotiation.

Low-cost foaming resins

A series of low-cost polyester resins for the manufacture of foamed urethane products is available from Pittsburgh Plate Glass Co., 632 Fort Duquesne Blvd., Pittsburgh 22, Pa. Designated Selectrofoam Resin 6207 (for flexible foamed products) and Selectrofoam Resins 6004 and 6005 (for rigid products), they are said to be superior in many ways to previous polyester and polyether foaming resins.

The flexible foaming resins provide good load-bearing capacity at low densities, higher resilience, good freeze resistance, and a soft feel. They can be foamed batchwise, by intermittent procedures, or continuously in a foam-making machine. A one-shot process is used and laboratory tests indicate that the foam can be molded without requiring prepolymer preparation. The resin has been foamed in slabs 12 in. thick and, according to the company, there appears no reason why it should not be possible to foam it into thicker slabs if desired.

Release paper

Riegel Paper Corp. is offering a new release and separating paper called Riegelease "G" which is said to provide efficient release for plastics, pressure-sensitive adhesives, and most any "sticky" item. It is suggested for use in polyester-fibrous glass lay-ups; with solid adhesive films that might be used on such items as vinyl floor tile or laminated surfaces; adhesive tapes; with urethane when an adhesive is required; and in many inter-plant operations where adhesives are difficult to handle.

Samples and information are available from Riegel's Technical Advisory Dept., 260 Madison Ave., New York 16, N. Y.

Enters urethane foam field

Scott Paper Co., manufacturer of sanitary paper products, has expanded its operation into the urethane foam field and will manufacture the material at its new Foam Div. in Chester, Pa., under the tradename Scottfoam.

The new foam, on which the company has patents pending, is available in several types. The firm states that the soft varieties of Scottfoam have greater tensile strength and elongation than conventional urethane foam and a wool-like feel and drape not found in any other foams. More rigid types, offered in a wide range of pore sizes, show promise as a filtering material.

Initial use of Scottfoam will be for garment interlinings. Brand & Oppenheimer, Inc., 233 Fourth Ave., New York, N. Y., has been named a distributor of the material.

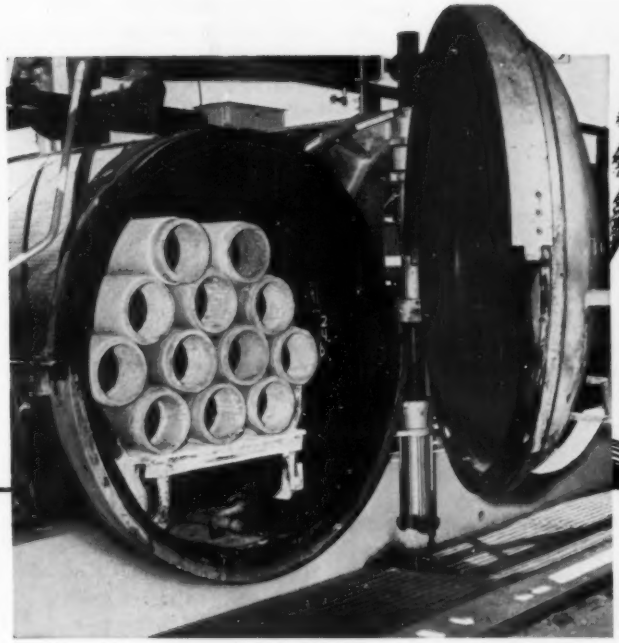
This is the company's first product totally unrelated to the paper industry.

Adhesives for Mylar and treated polyethylene

Three laminating adhesives for packaging and industrial applications—Resyn 30-1246, Resyn 36-6327, and Resyn 36-6328—have been announced by National Adhesives Div., National Starch Products, Inc., 270 Madison Ave., New York 16, N. Y.

Resyn 30-1246, a colorless and clear synthetic resin-based lacquer type, is recommended for laminating metallized Mylar to calendered vinyl film. Bond strengths are reported which are greater than that of the metallized coating to the Mylar. The adhesive dries to a tack-free film and, therefore, may be used as a heat-seal coating on metallized surfaces.

Resyn 36-6327 is a synthetic rubber-based lacquer said to have found widespread use for such applications as laminating treated polyethylene to clear

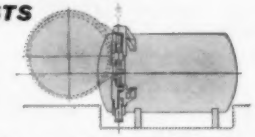


Memo to Production Engineers

◀ Adamson 90" dia. Hi-Lift Swing Door installed at Johns-Manville Products Corporation, Manville, N. J. One of many Adamson doors now in operation, or on order, for use in steam-curing TRANSITE® Pipe at J-M Plants in the U. S. and Canada.

Here are 6 important reasons why you should specify ADAMSON UNITED Hi-Lift Swing Vulcanizer & Autoclave Doors

1 LOWER INSTALLATION AND OPERATING COSTS



Adamson's lift-swing feature eliminates need for extended pit and expensive bridging. For example, on a 90" dia. door you can use an easily-handled loading bridge as short as 22".

2 TIGHT, LEAKPROOF SEAL

Adamson's special heat-resistant, self-sealing gasket utilizes vessel's internal pressure to assure a positive, leakproof seal.

3 EFFICIENT SLIDE-LOCK DESIGN



Provides virtually 360° of locking surface between door and mating shell ring. *Twice* the locking area of conventional breech-lock doors!

4 SAFE, RELIABLE OPERATION

Equipped with automatic door locking pins. Can be furnished with optional steam interlock controls for complete safety. Other built-in safety features included.

5 STRONGER CONSTRUCTION



Conventional castings are replaced by sturdy pressed steel head welded to continuous roll forged locking rings.

6 FAST OPENING AND CLOSING

Quick-unlocking, vertical-lift action powered by hydraulic cylinder. Door swings easily on anti-friction and bronze sleeve bearings. Simple, trouble-free operation.

7067

ADAMSON UNITED COMPANY

730 CARROLL STREET, AKRON 4, OHIO

Subsidiary of United Engineering and Foundry Company
Plants at Pittsburgh, Vandergrift, Wilmington, Youngstown, Canton

We offer a wide range of door sizes and pressures, available as integral equipment on vessels supplied by us, or as separate units for mounting on tanks made by other manufacturers. Write for catalog No. 562.

DESIGNERS AND BUILDERS OF BASIC MACHINERY AND EQUIPMENT FOR COMPLETE PROCESSES

The Plastiscope

Mylar and all saran-coated films. In addition, industrial uses such as adhering clear and metallized Mylar to nitrocellulose and vinyl-coated paper and cloth are reported.

Resyn 36-6328, also a synthetic rubber-based lacquer, is suggested for laminating both clear and metallized Mylar to itself and to paper. Other laminations include foil to Mylar and cellulose acetate butyrate.

High-low polymerization catalyst

Latest in a series of new Lucidol products, manufactured by Lucidol Div., Wallace & Tiernan, Inc., Buffalo 5, N. Y., is *p*-menthane hydroperoxide, a stable, non-volatile liquid hydroperoxide for use as a polymerization catalyst at both low and high temperatures. Where a low-temperature catalyst is required, it can be used by introducing metallic or amine promoters in the resin formulation. Pot life and cure time of the catalyzed resin depends upon the type of resin and promoter system used.

The company states that with general-purpose polyester resins, *p*-menthane hydroperoxide exhibits a low peak exotherm at 180° F.; at temperatures around 240° F., it is equivalent to benzoyl peroxide and methyl ethyl ketone peroxide. The presence of modifying or reinforcing agents in polyester-styrene systems does not affect it.

Polyglycols for urethane

Seven new resin-grade polyglycols tailored for urethane use are now available in tank-car quantities from The Dow Chemical Co., Midland, Mich. They include one diol and six triols—all based on glycerine, with propylene oxide as a building block.

Special properties reported by Dow include a narrow pH range, very low water content, unusually narrow molecular-weight range and distribution, absence of harmful ash, and low carbonyl level. Volatility and unsaturation are said to meet urethane industry requirements.

The diol, P-2000 (resin grade), is for use in flexible foams and elastomers. The number 2000 is the product's molecular weight.

The triols are resin-grade members of Dow's new family of polyglycols, the "11" series. They include: 11-80 for rigid and semi-rigid foams and urethane coatings; 11-100 for semi-rigid foams; and 11-200, 11-300, and 11-400 for flexible foams. In each product of this group, the number 11 identifies the series, and the second number denotes the viscosity in centistokes at 100° F.

The seventh new resin-grade polyglycol, also a triol, is designated 112-3 and is intended for flexible foams where essentially all primary terminal hydroxyls are desired.

Tank-car prices for these polyglycols range from 25¢ to 35½¢/pound.

The company also states that polybutylene, polystyrene, and polyepichlorohydrin glycols are available in developmental quantities.

Flame-retardant laminate

Insurok Grade XT-901, a plastic laminate which combines good electrical characteristics with flame retardance and arc resistance, has been developed by The Richardson Co., Melrose Park, Ill. Its flame retardance properties are unaffected by age or service conditions.

According to the company, electrical characteristics of the grade, which is identified by its distinctive red color, exceed the published N.E.M.A. values for XXXP phenolic laminates. Electrical and arc resistance properties of XT-901 are excellent and are retained after exposure to high humidity or immersion conditions. Other features are low water absorption and low edge and center expansion. The material can be fabricated readily with usual hot-punching equipment.

The combination of properties makes XT-901 suitable for high voltage and sliding contact applications.

Broadens distribution of laminates

After several years of producing decorative laminates for a few selected customers, Swedlow Plastics Co., Los Angeles, Calif., and Youngstown, Ohio, announces its entry into the market on a national basis. The company is now manufacturing a new flexible, decorative laminate composed of special grades of core papers, impregnated with an overlay of hard thermosetting resin. The material, called Kevinite, is reported to resist boiling liquids, grease, and solvents and to have long life.

The laminate is now available in a wide variety of patterns, colors, and wood grains through regular distribution channels. It comes in rolls 30 and 36 in. wide and may be purchased by the foot or yard.

Intermediates for urethane polymers

A new series of polyol polyethers which will enable urethane manufacturers to prepare a broad range of prepolymers for flexible foams has been introduced by Union Carbide Chemicals Co., Div. of Union Carbide Corp.

These intermediates are propylene oxide addition products of 1,2,6-hexanetriol, tradenamed Niax. Four polyethers, varying in hydroxy number from 42 to 240, which correspond to molecular weights from 4000 to 700, are available. Niax triols can be used alone or in combination with a polypropylene glycol such as Niax diol PPG-2025. Greater proportions of the triols increase the load-bearing properties and improve the compression-set characteristics of urethane foams.

Expected uses of the derivatives vary with their molecular weights. Niax triol LHT-42, with a molecular weight (MW) of 4000, will probably find its major application in soft foams for clothing interlining; triol LHT-

A Leading Molder Reports—



"We get a shorter mold cycle and greater shot size with Spencer Nylon." That's what Dick Rybak, Chief Engineer of R & K Tool and Die Company of Cleveland, is telling Spencer Representative Carl Virgin. Rybak also found that Spencer Nylon shrinks less, eliminates the problem of nozzle drooling, and has greater "weldability."

"They Couldn't Burst-Test Spencer Nylon...

...their testing apparatus failed first!"

Spencer Nylon's startling toughness recently solved a particularly difficult design problem encountered by Dick Rybak, Chief Engineer of the R & K Tool and Die Company of Cleveland. Specialists in custom-molding, R & K have as one of their projects the manufacture of plastic fittings to be used primarily with polyethylene pipe.

Particularly tricky is the problem of connections for pumps and tanks where considerable vibration occurs. For such connections metal is objectionable on the grounds of expense and corrosion. Previously-tested high-impact plastics sometimes gave way under the vibration strain. Only a material with higher tensile strength would really do the job.

Could Spencer Nylon fill this need? A testing lab checking some fittings made by R & K of Spencer Nylon found they couldn't run a burst-test on the material. Their own apparatus failed first. To say the least, Spencer Nylon was strong enough. And because Nylon fittings are abuse-resistant, threaded parts were easier to protect in shipping.

And Spencer Nylon 401 offered several extra advantages over other types of nylon. Rybak found that 401's wider plasticizing range enabled him to use a four-cavity mold, something he had been unable to do with other nylons. (This wider tolerance of 401, incidentally, is what enables other molders to make pieces with larger surface areas and thicker cross sections.)

There's less mold shrinkage, too, Rybak declares. The R & K firm also contends they get a much greater uniformity in color of their fittings — a decided factor in the salability of the finished product.

Drooling nozzles are no problem when the molder uses Spencer Nylon 401, says Rybak, and attributes this to 401's higher viscosity at molding temperature.

Finally, there's no "weld line" when you weld with Spencer Nylon 401. That means the weak spot encountered with other kinds of plastic is eliminated with nylon.

Many processors are finding that Spencer Nylon also offers special advantages for injection moldings, centrifugal casting, and extrusion molding, as well as for the extrusion of pipe and film.

You too may discover that Spencer Nylon can help you solve a knotty design problem. For complete information write to Spencer Nylon, Spencer Chemical Company, 620 Dwight Building, Kansas City 5, Missouri.

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GENERAL OFFICES: DWIGHT BUILDING, KANSAS CITY 5, MISSOURI



(Purdue University silo cover by Visking Corp.)

Agricultural uses for black polyethylene film (like this trench silo cover) represent a huge new market. A proven, new "Poly-Eth" resin makes it possible for you to produce the kind of film it takes to go after this profitable business. Read details below:

In Film Extrusion . . .

"Poly-Eth" 3226 For Black Film

This special resin with 5% carbon black gives you tough, opaque black film:

Several million pounds of black polythylene film will be used this year as ditch liners, as mulch, and to cover hay, trench silos, lumber and machinery. These and many other uses for black film offer you tremendous profit opportunities. The 20 x 100 foot 6 mil silo cover above, for example, weighs nearly 60 pounds!

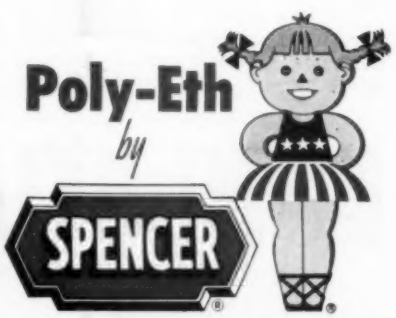
But it takes a special film to attract this kind of business. Farmers insist on a black film that is tough enough to stand up under rough handling and exposure to severe heat and cold.

With these facts in mind Spencer Chemical Company has developed a "Poly-Eth" resin—"Poly-Eth" 3226—that is specially designed to produce a tough, all-purpose black film. Since ultra-violet resistance is so important, "Poly-Eth" 3226 contains 5% carbon black.

Farmers themselves will tell you that film made of "Poly-Eth" 3226 has the toughness it takes to withstand plenty of rough handling. They've found, too, that it remains flexible over a wide range of temperatures, and that most strong acids and alkalies won't affect it.

Extruders have found that "Poly-Eth" 3226 processes easily, drawing down to extremely thin gauges.

Discover for yourself the advantages this new Spencer resin offers you in the production and sale of black film. Just drop a line to: Spencer Chemical Company, Dwight Bldg., Kansas City 5, Mo.



The Plastiscope

67 (MW=2500), in furniture and automotive cushioning; triol LHT-112 (MW=1500) in flexible foam as a cross-linking agent with polyether diols; and triol LHT-240 (MW=700), in semi-rigid foams.

Metallized film

A heat-sealable, 2-mil polyester film that looks like aluminum foil but can be flexed almost indefinitely without affecting film properties has been announced by Minnesota Mining & Mfg. Co., St. Paul, Minn. A metallized version (No. 20A20) of the firm's Scotchpak heat-sealable polyester film, it is especially suited for packaging materials which must retain volatile elements during storage periods.

The material is said to have a water vapor permeability of 0.02 g./100 sq. in./24 hr., air permeability of 0.02 cc./100 sq. in./24 hr., and oxygen permeability of 0.06 cc./100 sq. in./24 hr.

The film retains its properties in a temperature range of —70 to 230° F. and displays good heat reflectivity with very low heat conductivity. Tensile strength is 8000 p.s.i.; burst strength (Mullen) is 40 p.s.i.

Polyethylene storage bottles

A line of standard-weight amber polyethylene bottles, especially useful for storing light-sensitive materials, is now available from the Nalge Co., Inc., 625 S. Goodman St., Rochester 20, N. Y. The bottles are in Boston round shapes and are offered in 1-, 2-, 4-, 8-, 16-, and 32-oz. sizes as well as in ½- and 1-gal. units.

Expansion

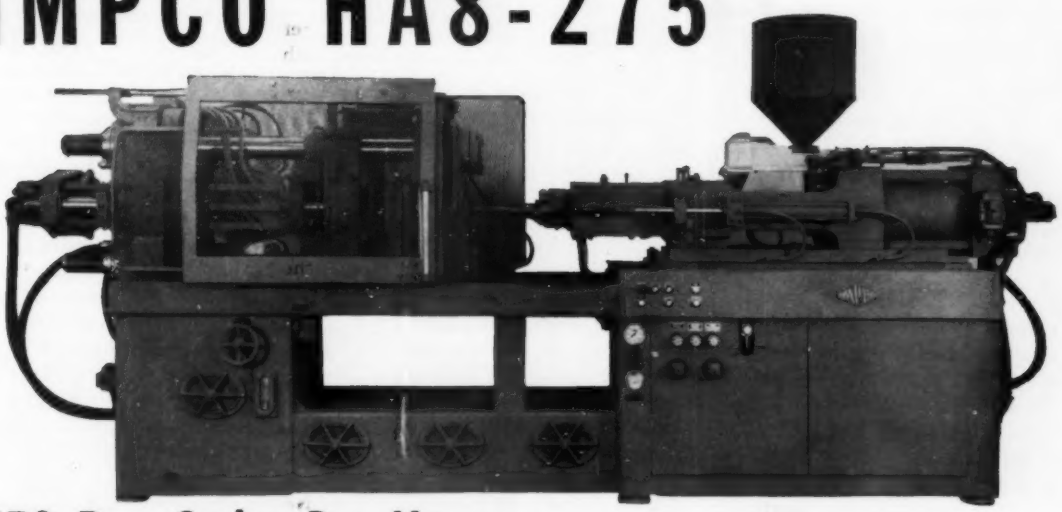
Champion Paper & Fibre Co., Hamilton, Ohio, has acquired half ownership of **NRC Vaculite Corp.**, Cambridge, Mass., subsidiary of **National Research Corp.** The joint company will undertake a major program to commercialize a new vacuum-metallized paper for packaging, building insulation, and other applications. Both parent companies will pool their know-how in the paper metallizing field and jointly supply management talent.

Officers of Vaculite are as follows: **Henry W. Rigby,** president, and **Maynard D. Conklin,** treasurer, both of whom are officers of Champion Paper; **Richard M. Nichols,** secretary and clerk, and **David D. Nickerson,** assistant treasurer, both officers of National Research.

Monsanto Chemical Co. and **Carbometal S.A.I.C.**, Mendoza, Argentina, are working out an arrangement for the manufacture of vinyl chloride monomer and Opalon, Monsanto's PVC, at a new plant to be constructed in Mendoza.

Construction of the new manufacturing facilities is expected to begin during the first half of 1958. It is anticipated that the plant will be capable of filling the needs of PVC in Argentina. Both

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Ketone Peroxide #6	90.0% (min.)
Active Oxygen	6.25% (min.)

PROPERTIES:

A white, fine powder with 66-68°C. melting point.

Solubility at 20°C. (weight percent):

Slight solubility (1-5%) in water, glycerol ethylene glycol, most esters and hydrocarbons.

Moderate solubility (5-15%) in alcohols, tricresyl phosphate, ketones and chlorinated hydrocarbons.

Soluble (15-50%) in ethers and methanol.

APPLICATIONS — When LUCIDOL KETONE PEROXIDE #6 is used in conjunction with metallic promoters, faster gel times are obtained than with other commercial ketone peroxides. Workable pot life of polyester resins catalyzed with it is considerably lengthened providing no selective accelerators are present. Exotherm measurements (S.P.I. procedure) at 180°F. using unsaturated polyester resins show that it combines long cure time with fast gel time. A lower peak exotherm temperature is obtained with LUCIDOL KETONE PEROXIDE #6 with some resins than with any other ketone peroxide. LUCIDOL KETONE PEROXIDE #6 should prove advantageous in applications involving molding, casting or potting where crazing is to be avoided. *Write for Data Sheet*

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The Plastiscope

flexible and rigid types of polyvinyl chloride resins will be produced.

Carbometal is one of the leading producers of calcium carbide and ferro alloys in Argentina.

Eastman Chemical Products, Inc. announces that production of a new medium-density Tenite polyethylene, designated Series 100, has begun at the Texas Eastman Co. plant in Longview, Texas. It also announced that over-all polyethylene production capacity at the Longview plant will be increased by more than 50% to 85 million lb. per year by the end of 1958. This will be the third expansion of Tenite polyethylene capacity since 1954.

Spencer E. Palmer, vice president of Eastman Chemical, states: "As compared to low-density, conventional-type polyethylene, the use of Series 100 Tenite polyethylene means greater stiffness, higher heat resistance, and greater resistance to abrasion in molded products."

Mr. Palmer also pointed out that film extruded from it is stiffer; paper coaters can expect to produce a laminate which will have improved grease resistance; the improved heat resistance makes it a more effective insulation for wire coating; the material will be suitable for stiffer, thinner-walled containers with less permeability to various oils and solutions; and users of extruded pipe will benefit from its ability to withstand higher pressures and temperatures.

Northwest Plastics, Inc., St. Paul, Minn., is planning to double the size of its recently completed molding plant in Gastonia, N. C. The subsidiary factory, called **Northwest Plastics of Carolina, Inc.,** produces electrolytic condenser enclosures. It is currently operating nine compression presses and one injection unit.

National Automotive Fibres, Inc., Detroit, Mich., has acquired **Electrophysical Engineering Co.,**

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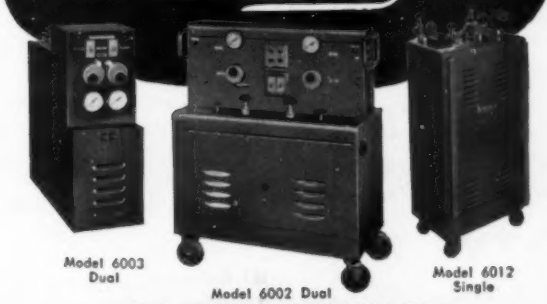
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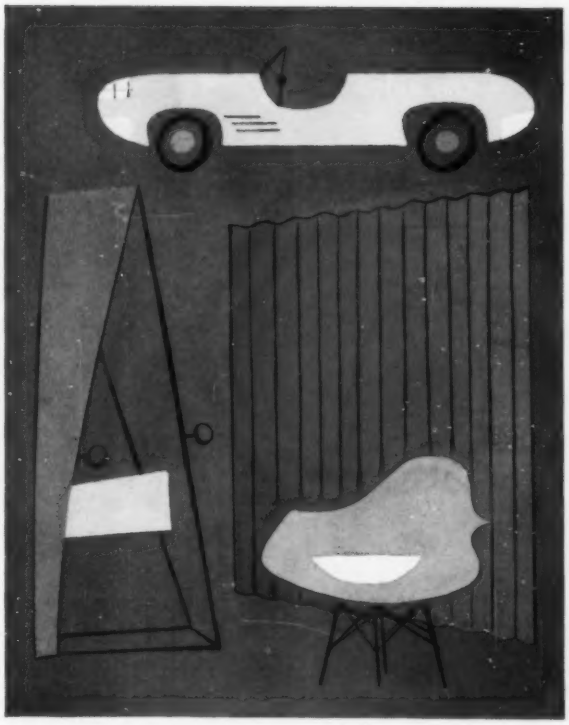
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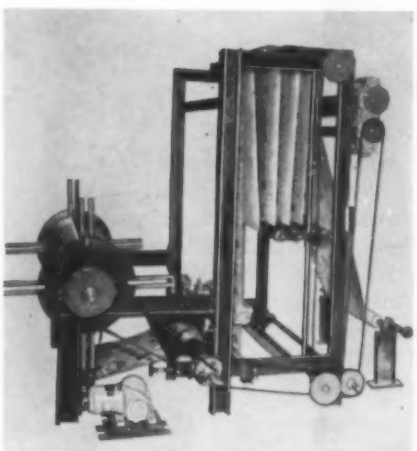
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The Plastiscope

Inc., Los Angeles, Calif., which will operate as a new division of NAFI. Electrophysical will be relocated to the parent company's Orange, Calif., plant. The division will be engaged in the manufacture and further development of induction heating extruders and related machinery.

Robert H. Wenzel, former owner and president of Electrophysical, will continue as manager of the new division.

Monsanto Chemical Co. has installed equipment at its Plastics Div. in Springfield, Mass., which is expected to increase the firm's polyvinyl chloride compounding capacity by 75 percent. Last year, Monsanto completed an expansion which more than doubled its capacity to product its Opalon vinylchloride resins.

Tel-A-Sign, Inc., Chicago, Ill., producer of illuminated plastic signs for point-of-purchase dealer-identification, plans to double its plant facilities to 120,000 sq. ft. by adding a wing to the present structure.

The company, which was recently admitted to trading on the American Stock Exchange, reports total sales for the first six months of its fiscal year to August 31, as $1,003,052.08 and a net profit of $87,390.59, compared with total sales for the fiscal year ended February 28, 1957 of $1,134,357.51 and a net profit of $50,767.99.

Airconductors, manufacturer and fabricator of plastic ducting, tubing, and weatherproof covers for the aircraft, missile, and electronics fields, has moved from Compton, Calif., to a new and larger building at 367 E. Olive St., Gardena, Calif. The structure will be equipped with enlarged testing facilities as well as a research and development laboratory.

Owens-Illinois Glass Co. will erect a 60,000-sq. ft. warehouse at the

(*To page* 256)

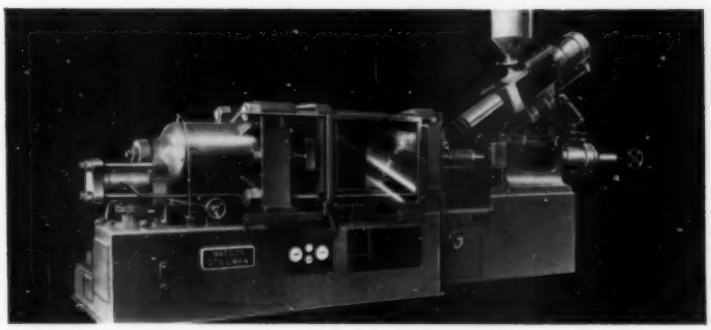
How to keep speed up, rejects down... in deep-draw molding

These smart new products, though large, are smooth and accurate. That quality is typical of piece after piece turned out on the Watson-Stillman PE-64, preplasticizing-type, injection molding machine.

Engineered to be as modern as the products you'll mold with it, the PE-64 offers many standard features usually considered "special" in this type of equipment. They provide exceptional productivity, fewer rejects for lower unit cost.

The preplasticizing unit, for example, delivers shorter cycles with lower injection pressures, better control of shot thickness and greater uniformity in material and coloring. Other features include: New-design heating cylinder with four-zone heat control... simple die set-up with inching-control wheel... straight hydraulic clamp providing larger stroke for molding deeper pieces.

These and many other features of the PE-64 are described fully in bulletin 624. Write for your FREE copy today. Information also available on vertical injection machines, compression and transfer molding presses.











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Announcing... *Monsanto's improved film resin for industrial packaging and barrier uses*

MONSANTO POLYETHYLENE 706

Monsanto Polyethylene 706 resin has been developed specifically for industrial packaging and barrier uses. An unmodified resin containing no additives, 706 meets the most exacting requirements for industrial film applications regardless of the fabricated product—from toughness and uniformity of appearance to ease of handling on fabricating machines and openability. This outstanding new resin is chemically inert and possesses carefully controlled physical properties.

Already performing for many important film extruders, this newest in the expanding Monsanto Polyethylene resin series is now available in full commercial quantities. For complete data, and other information, write Monsanto Chemical Company, Plastics Division, Room 1771, Springfield 2, Mass.



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Tube Openability
"Excellent"... over a wide range of gauges and extrusion speeds.

Extrudability
"Maximum performance" ... can be drawn to a 0.5 mil gauge.

Appearance
"Highly uniform translucence"... uniform fine grain structure.

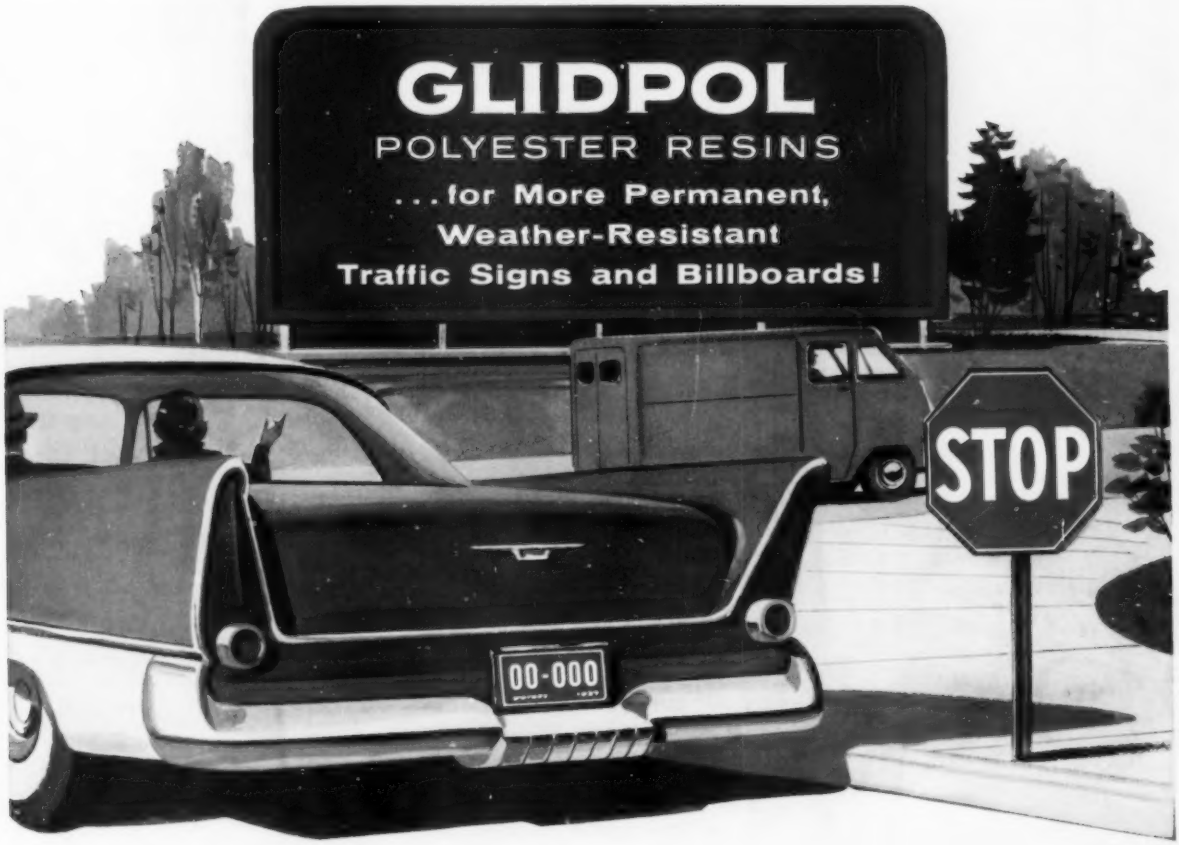
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St. Charles, Ill., plant of the Closure and Plastics Div. Construction is expected to be completed during the summer.

Items made at the plant include compression molded phenolic and urea closures, injection molded thermoplastic fitments for glass containers, and other plastic containers and products.

Deceased

Christopher William Browne, 71, a former editor of *Modern Packaging* Magazine and *Modern Packaging* Encyclopedia Issue, died on December 28 following a long illness. He joined *Modern Packaging* Magazine in 1941 and was editor during the war years, a time when business publications were subject to severe restrictions as well as to grave responsibilities to the war effort. One of the foremost authorities in the country on packaging, Mr. Browne in recent years was advisory editor on *Modern Packaging* Magazine and the Encyclopedia. Prior to his association with *Modern Packaging*, he was manager of marketing service for U. S. Printing & Lithograph Co., Cincinnati, Ohio.



C. W. Browne

C. Dudley Clawson, president of **Ferro Corp.,** Cleveland, Ohio, died on January 4 of a heart attack while on a trip to Mexico City, Mexico. Mr. Clawson had been president of the company since 1947.

Stanhope Wood Nixon, 63, board chairman of **Nixon Nitration Works** and son of its founder, died on January 11 in University Hospital, New York City, after a long illness. He had supervised the Nixon plant since the death of his father, Lewis Nixon.

Archibald W. Paull, Sr., 88, president of **Wheeling Stamping Co.,** Wheeling, W. Va., died on December 2. Mr. Paull succeeded his father as president of the firm in 1898 and had held the post since that time.

Commander Richard K. West, head of West Instrument enterprises, was lost while flying his company plane over Lake Erie. "Dick" West was with Bakelite Co. before World War II. He was prominent in plastics affairs with the U. S. Navy during wartime operations.

Meetings

Plastics groups

March 6-7: The Society of the Plastics Industry Canada, Inc., Sixteenth Annual S.P.I. Canadian Section Conference, Royal Connaught Hotel, Hamilton, Ont.

March 26-28: The Society of the Plastics Industry, Inc., Pacific Coast Section, Fifteenth Annual Conference, El Mirador Hotel, Palm Springs, Calif. Subject: "Progress in Plastics."

June 26-27: The Society of the Plastics Industry, Inc., S.P.I. Midwest Section Conference, French Lick-Sheraton Hotel, French Lick, Ind.

Other meetings

April 15-17: Society of Chemical Industry, Plastics and Polymer Group, Symposium on "The Physical Properties of Polymers." Additional information may be obtained from Mr. K. H. C. Bessant, The Distillers Co., Ltd., Great Burgh, Epsom, Surrey, England.

May 1-8: American Society of Tool Engineers, Annual Meeting and Tool Show, Philadelphia Convention Center, Philadelphia, Pa.

May 20-21: The Chemical Market Research Association, Annual Business Meeting and Open Technical Session, Hotel Statler, New York, N. Y.

May 28-29: Deutsche Gesellschaft Für Chemisches Apparatewesen (DECHEMA), 2nd Congress of the European Federation of Chemical Engineering, Brussels, Belgium. (To be continued at Frankfurt am Main, Germany, May 31-June 8.)

May 31-June 8: DECHEMA, European Congress of Chemical Engineering and ACHEMA 1958 Congress, 12th Exhibition and Congress of Chemical Engineering, Frankfurt am Main, Germany.

Companies . . . People

Allied Chemical & Dye Corp.: Kerby H. Fisk, chairman of the Executive Committee, elected chairman of the board to succeed **Fred J. Emmerich**, who has retired but will continue as a director. **Carlton Bates**, formerly president of **Solvay Process Div.**, and **Harry S. Ferguson** elected to the newly created posts of executive vice presidents; **Chester M. Brown**, president of **General Chemical Div.**, elected a vice president. **James J. Armstrong** named director of management engineering.

National Aniline Div.: Harris B. Fenn, Jr., previously West Coast resident manager, promoted to manager of dyestuff sales, a newly created post at the firm's general office in New York City, where he will be responsible for sales of dyestuffs on a nationwide basis, reporting to **Harold L. Rieg**, director. **Eric W. Camp**, formerly resident manager of the Chicago branch since 1943, replaces Mr. Fenn on the West Coast, with headquarters at the firm's new consolidated office at 235 Montgomery St., San Francisco, Calif. **Charles C. Knights**, resident manager of the New York sales branch since 1927, has retired after 40 years' service with the company.

Union Carbide Corp.—Union Carbide Chemicals Co.: John A. Field, a vice president since 1954, appointed to newly created post of vice president—marketing. He will be in charge of all chemical marketing functions now being consolidated in an integrated company marketing organization. **W. F. Allen, R. S. Hammerness, J. A. Helm, Jr., J. F. Lombard, S. G. Panayides**, and **W. H. Rogers** joined the Institute, W. Va., plant.

Bakelite Co.: W. C. Quinby, formerly technical representative of the Flexible Packaging Materials Div. in the Cincinnati district office, promoted to assistant sales manager of the division at New York headquarters. The division is responsible for the sales of the company's polyethylene and vinyl plastics used in the manufacture of flexible packaging.

Du Pont—Polychemicals Dept.: Robert L. Hershey, with the company 21 years and formerly general manager of the department, elected a director, vice president, and member of the Executive Committee. **Walter H. Salzenberg**, assistant general manager, succeeds Mr. Hershey as general manager of the department. **Dr. William E. Grisby**, manager of sales technical services, transferred to the Development Dept. **Doyce B. Hanson**, formerly director of the department's sales service laboratory at Chestnut Run, replaces Dr. Grigsby as manager of sales technical services. **Irénée du Pont, Jr.**, formerly assistant director of the laboratory, advanced to director and **Frank L. Brevoort**, senior supervisor, now assistant director.

American Cyanamid Co.—Plastics and Resins Div.: Daniel McC. Collette, with the firm since 1941, named manager of manufacturing to succeed **William D. Holland**, appointed assistant general manager of the recently formed Commercial Development Div. **Vladimir J. Wilhousky**, previously operations manager, replaces Mr. Collette as manager of the Wallingford, Conn., plant.

Formica Corp.: North Central regional office established in American Cyanamid's consolidated offices at 3505 N. Kimball Ave., Chicago, Ill., resulting in the reassignment of three sales executives: **Charles G. Reiter**, formerly district manager at Belleville, N. J., heads the North Central office; **Howard K. (Duke) Gladfelter**, previously district manager in Milwaukee, Wis., now manager of the Belleville district office; and **John Hagstrom**, a salesman for the Chicago district office, promoted to district manager of the Milwaukee office.

The South Central regional office, headed by **T. L. Eagen**, will continue to operate from the American Cyanamid Bldg., 2350 Glendale-Milford Rd., Cincinnati, Ohio.

Monsanto Chemical Co.—Overseas Div.: James R. Turnbull, who has completed his three-year assignment with **Monsanto-Kasei Chemical Co.**, Tokyo, Japan, will be succeeded by **Bertram K. Denton**, who will become vice president and a director of the Japanese associated company.

Plastics Div.: Dr. R. I. Dunlap appointed director of research administration, responsible for research planning, budgetary control, pilot plant operations, and personnel activities at Springfield, Mass. **J. S. Nelson** named assistant director of research in charge of Saflex polyvinyl butyral, vinyl film, and Vuepak cellulose acetate film and sheets. Miss **Emma Lee** now a member of the Research Dept. and **Robert Storch** joined the Engineering Dept. **Dr. W. H. Lane**, assistant director of research at Texas City, Texas, has assumed responsibility for polyethylene and exploratory research in addition to research administration, planning, and budgetary control. **S. L. Hunter**, previously production manufacturing superintendent of the Texas City plant, now assistant director of research, responsible for all monomer process research and pilot plant activities. **Roger S. Leland** now with the technical service section, Texas City. **H. G. Schleicher**, formerly manager of the division's plant at Long Beach, Calif., promoted to resident research project manager at the firm's Dayton, Ohio, laboratories to direct the polyolefin pilot plant program.

Organic Chemicals Div.: Dr. S. Allen Heininger, previously a group leader in the Research and Engineering Div., named a project specialist in the Development Dept.

Sun Chemical Corp.: Eric N. Blackstead elected vice president of the company and general manager of the chemicals group composed of **Electro-Technical Products Div.** (insulation materials, laminants, and plastics); **Warwick Chemical Div.** (textile and industrial chemicals); **Warwick Wax** (specialty waxes); and the recently acquired **Ansbacher-Siegle Corp.**, manufacturer of U. S. Government certified colors for the drug and cosmetic industries, as well as organic pigment colors for the plastics, ink, paint, and floor covering industries. Mr. Blackstead was formerly vice president and general manager of Ansbacher-Siegle. **Thomas J. Craig** appointed assistant general manager of the graphic arts group.

Knowlton Brothers, Inc., Watertown, N. Y.: **Dr. Fritz Rosenthal**, formerly project leader in the polymer plastics section of the Chemistry Dept. of the Armour Research Foundation, appointed to the Research Dept. as director of product development. He will join **Horace Spencer** in directing the research activities of the company. The research staff will specialize in the application of new types of fibers and additives in paper manufacture, and in the development of new and improved technical papers for industrial use.

The addition of a new development and research laboratory is the latest step in the company's current million dollar modernization and expansion program.

Interchemical Corp. has consolidated its R-B-H Dispersions and Textile Colors Divs. into a new Color and Chemicals Div. **William N. Davies**, formerly president of Textile Colors, named general manager of the new unit. **William J. Rothemich** named general production manager and **Harold D. Craft** general sales manager of the Color and Chemicals Div., which will have its headquarters at Hawthorne, N. J.

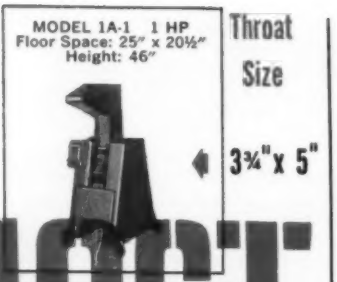
The Bound Brook, N. J., factory will continue its production of pigment dispersions under the R-B-H tradename for the coatings and plastics industries under the direction of **William T. Hulse**; the sales organization for R-B-H products will remain

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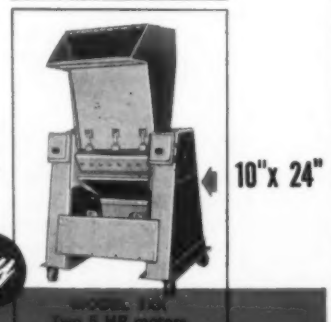
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Companies . . . People

under the supervision of **Richard L. Lynch,** whose title will be sales manager—coatings and plastics industries; **Philip H. Ingham** will continue to head the Bound Brook laboratory as manager of development—dispersions for coatings and plastics; **Albert Saunders** will be manager of the newly established Commercial Development and Evaluation Dept.; **Ludolph H. Conklin, Jr.** will be assistant sales manager—coatings and plastics industries, in addition to his present duties as manager of technical sales service.

Nosco Plastics, Inc.: Ruben G. Kugel, formerly executive vice president and treasurer, appointed president. He has been associated with Nosco and its predecessor, National Organ Supply Co., during his entire busi-





Ruben G. Kugel **Paul C. Roche**

ness career. **Paul C. Roche,** with the firm since 1945 and previously vice president and sales manager, named vice president and general manager; he was also elected to the company's board of directors. Nosco is a custom molder of plastic components.

Duall Plastics, Inc., 764 S. Athol Rd., Athol, Mass., is a new company organized by **R. S. Jesionowski,** formerly with Plax Corp. and more recently president of Jessall Plastics, Inc., which was sold to Electric Storage Battery Co. An early pioneer in design and operation of extruders, Mr. Jesionowski is well known in the industry for making his machine produce incredible results.

Cadillac Plastic & Chemical Co., 15111 Second Ave., Detroit 3, Mich., appointed national distributor by **Bakelite Co.** for its epoxy resins and hardeners. Principal outlets which will be served by the new distribution set-up include tooling, foundry, aviation, electrical, electronics, marine and chemical industries, and kit packagers.

Cadillac will carry complete stocks of Bakelite epoxy resins and hardeners for immediate delivery in its warehouses in Detroit, Chicago, Cincinnati, Cleveland, Dallas, Kansas City, Los Angeles, Milwaukee, St. Louis, and San Francisco. It will also maintain a technical advisory service for epoxy users and dealers. The appointment rounds out the company's distribution of materials for fibrous glass-reinforced plastics,

which now include: Uniglass glass cloths, Fiberglas glass mats, rovings and fibers; Marco polyester resins; Sigma peroxides; PMI pigments; Mono-Sol PVA films; and Cadco parting agents, solvents, etc.

The Borden Co.—Chemical Div.: David F. Lowry, formerly assistant sales manager, promoted to manager of the recently formed new products department of the Polyco-Monomer Dept. **Joseph H. Kiernan,** previously a sales representative, promoted to product manager of the company's Placco-brand building materials products, with headquarters at Middlesex, N. J.

Resin Research Laboratories, Inc., Newark, N. J., has formed a new division devoted to market survey and sales development related to resins and polymers, its related raw materials, and its multiple applications. Branch facilities will be available in Newark, Chicago, and the West Coast.

Pelron Corp., Lyons, Ill.: **John J. Ratto** appointed general sales manager. **William Clement** and **Ronald Greiner** named technical sales representatives for the Polyurethane Div., working out of the firm's Detroit office.

Landers Corp.: W. Garwood Bacon, Jr. appointed sales manager for the New York area and **C. Gordon Statham** manager of the Atlanta, Ga., sales area.

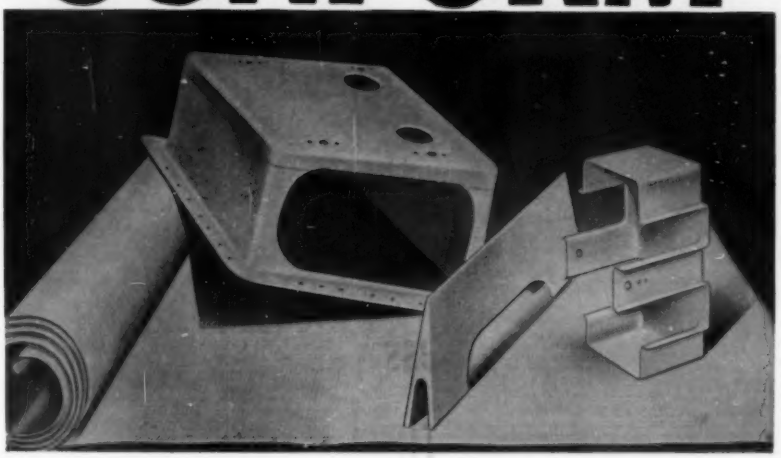
The Fiberite Corp., Winona, Minn., manufacturer of plastic molding compounds, has appointed **Bakelite Co., Div. of Union Carbide Canada, Ltd.,** its exclusive sales representative in Canada. Bakelite's general sales office is located at 40 St. Clair Ave E., Toronto, Ont., and its district sales office at 1425 Mountain St., Montreal, Que.

Food Machinery & Chemical Corp.: Bernard H. Jacobson, vice president, appointed business and technical consultant to the Chemical Divs. He also becomes a member of the Operating Committee of FMC's Chemicals Divs. Mr. Jacobson was president of Ohio-Apex Co. which became part of FMC in 1951.

Becco Chemical Div.: Dewey H. Nelson promoted to assistant manager of the division. He will also continue as sales manager, a position held by him since 1956.

The General Tire & Rubber Co.—Bolta Products Div.: Bomar Kramer, formerly product sales manager in charge of original automotive equipment, transferred to the manufacturing analysis group at the corporate office in Akron, Ohio. He is succeeded by **Dave Donnan,** previously sales manager of saran monofilament yarns. **James J. Pol-**

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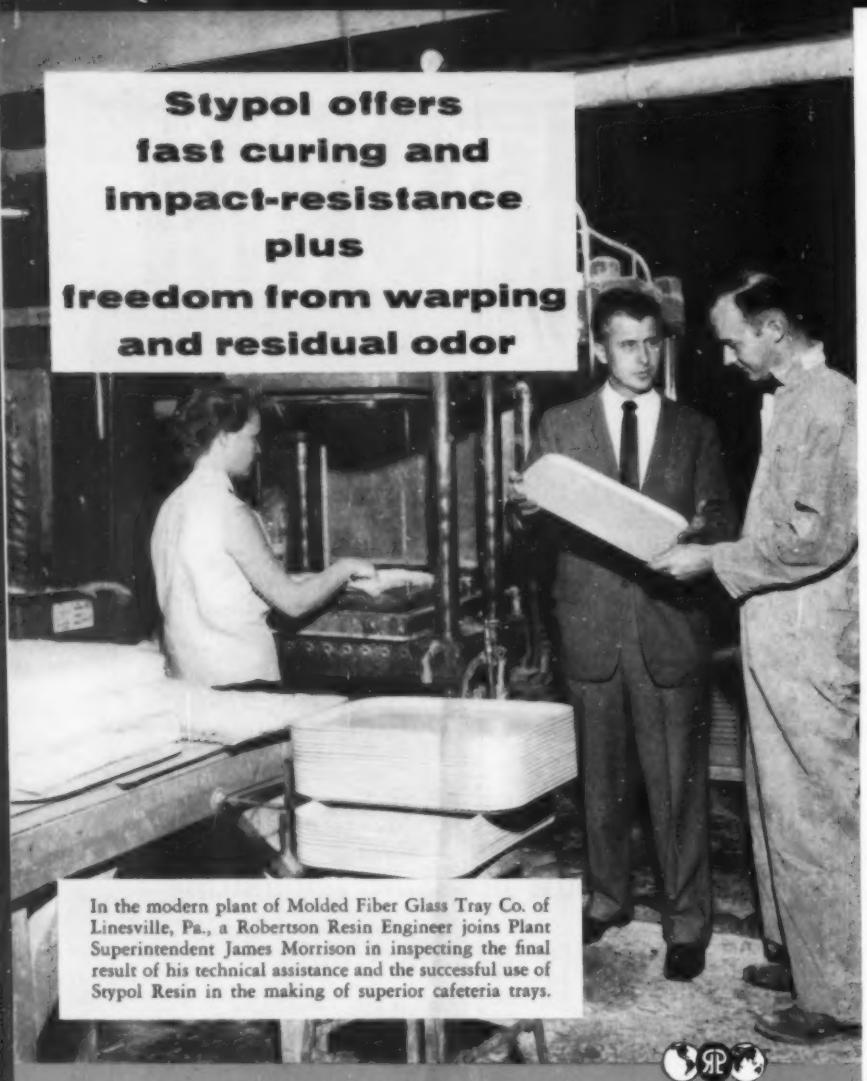
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lack, formerly sales representative for the Retail Div., replaces Mr. Donnan as sales manager of saran monofilament yarns.

Marion Div.: Thomas H. Wilson named eastern regional manager of Polyfoam sales. He has been affiliated with the company as market research analyst since 1952.

W. R. Grace & Co.—Grace Research and Development Div.: Dr. Nelson S. Marans, formerly senior scientist for Westinghouse Electric Corp., appointed research chemist. He will be concerned with the physical chemistry of polymers.

Polymer Chemicals Div.: Frank Costas, William Haddad, and **Walter Zagar** have joined the staff as research chemists.

Dewey and Almy Chemical Co.: J. Wade Miller, Jr., formerly manager of the Industrial Relations Dept., named manager of the Central Services Div. He will be in charge of advertising, industrial relations, marketing research, office services, public relations, and purchasing. **Riegel Paper Corp.: J. Bicknell Lockhart** elected a vice president; he will continue as manager of merchant and industrial sales. **Frederick M. Jennings,** assistant secretary, elected to Mr. Lockhart's former office of secretary of the company.

The Richardson Co.: Harry Burger appointed manager of development and design; **Harry Ripkey** named field sales manager of the Plastics Div. **John McHugh** now production manager of the Melrose Park, Ill., plant and **Neil Hoesel** corporate manager of quality control. The company manufactures molded and laminated plastics parts for the automotive, electrical, and other industries.

Phillips Petroleum Co.—Phillips Chemical Co.: Following are promotions to newly created positions in the Plastics Sales Div.: **W. R. Clark,** sales manager; **W. H. Guthrie,** manager of sales promotion; **R. M. Wallace,** sales coordinator; and **D. S. Sherwin,** manager of marketing research. **R. V. Jones** continues as manager of technical services and development. The Plastics Sales Div. is headed by **George Wash,** who previously also acted as sales manager.

S. W. Goodman Co., 32 W. Biddle St., Baltimore, Md., appointed technical sales representative for **Tri-Point Plastics, Inc.,** Albertson, N. Y., covering Maryland, the District of Columbia, and northern Virginia. Goodman specializes in electronic components and will handle Tri-Point's TSI Teflon rod; precision-

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machined Teflon and other plastic parts for the electronics industries; Trinseel sub-miniature Teflon stand-off and feed-through terminals; and related electronics products still under development.

B. F. Goodrich Chemical Co.: Harold E. Bechtold, Jr. appointed a plastic materials sales representative at the Los Angeles district sales office. He will also represent the General Chemicals Sales Dept. in the West Coast area. **Theodore W. Hummel** named a plastic materials sales representative, with headquarters in the New York City office.

Synthane Corp., Oaks, Pa., has relocated its Cleveland sales office from the Western Reserve Bldg. to 3597 Lee Rd., Cleveland 20, Ohio. **Foster A. Hall** is district sales representative. **Duane E. E. Roland**, former general manager in charge of production, who retired last year, elected to the board of directors. The company manufactures industrial laminated plastics.

Claremont Pigment Dispersion Corp.: Bill Krause appointed New England sales representative to spearhead sales of Maxiprint flexo inks to converters of all flexible packaging film. **Murray Marlowe** and **Sid Borgia** will cover the New York metropolitan area.

McGreevy Associates, 107 South St., Boston, Mass., appointed New England sales agents for **Textileather Div., The General Tire & Rubber Co.**, Toledo, Ohio. Associated in the sales agency are **Thomas J. Hartnett**, of **Harvey Hartnett, Inc.**, who has more than 25 years industrial sales experience in the New England area; **Robert E. Borden**, formerly a sales product manager for Textileather; and **Gerald H. McGreevy**, who recently retired as Textileather's director of sales after more than 30 years with the company.

Victory Mfg. Corp.: Ray Stratman named sales manager of the Housewares Div.; Arthur E. Backus appointed sales manager for industrial and custom molding. The company is a thermoplastics molder.

The Sherwin-William Co. and **B. F. Goodrich Industrial Products Co.** have completed arrangements for Sherwin-Williams branches to market Koroseal vinyl wall covering in all principal marketing areas in the nation.

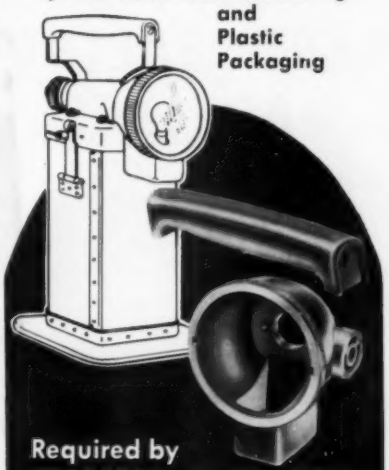
Lombard Governor Corp.—Injection Molding Machine Div., Ashland, Mass.: Following midwestern representatives appointed: **Neff, Kohlbusch & Bissell Co.**, 5700 W. North Ave., Chicago 39, Ill., for Indiana, northern Illinois, Wisconsin, Minnesota, and eastern Iowa; **Joseph Monahan Co.**, 351 Indiana Ave., N.W.,

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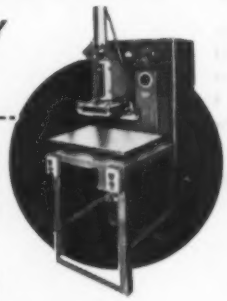
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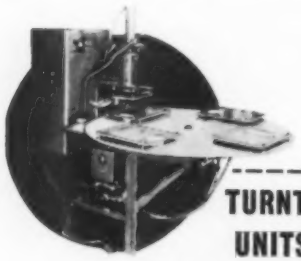
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Grand Rapids, Mich., for western Michigan; and **Addy & Luby Machinery Co.**, 8601 Second Blvd., Detroit 2, Mich., for eastern Michigan.

L. R. Wallace & Co., manufacturer of Walco Roller Coater equipment for plastics, has moved from 191 N. Pasadena Ave. to new and larger facilities at 172 N. Vernon Ave., Pasadena, Calif., and is now prepared to fill all new orders promptly.

Pittsburgh Coke & Chemical Co.: Thomas E. Smith and **Walter J. Blaha** have joined the Chemical Plant Engineering Dept. as a chemical engineer and maintenance engineer, respectively. Mr. Smith assigned to the department's Process Improvement Section and Mr. Blaha to the Maintenance Engineering Section.

Armstrong Cork Co.—Glass and Closure Div.: R. C. Wagner transferred from the Dallas office to the Chicago district office and **J. R. Foley** from the Atlanta district office to Milwaukee. New assignments include **D. R. Barry** to St. Louis, **K. L. Cox** to Dallas, and **T. R. Krueger** to the Chicago district office.

Nuodex Products Co., Div. of Heyden Newport Chemical Corp., has established a new department to supply and market organic peroxide catalysts to the plastics industry, with **Joseph Palumbo** as sales manager. The department will have its own application and service laboratory, and warehousing facilities are being set up at key locations across the country.

Taylor Fibre Co. has moved its New England branch office from West Newton, Mass., a suburb of Boston, to 967 Farmington Ave., W. Hartford, Conn. **Charles R. Whitehorne** is district manager; **James J. Ratchford, Robert H. McEvoy**, and **Charles C. Currier, Jr.** named sales engineers for the New England territory.

E. V. Larson Co., Ltd., 572 Queen St. E., Toronto 2, Ont., appointed Canadian sales representative by **Davis-Standard, Div. of Franklin Research Corp.**, Mystic, Conn. Larson will handle the entire line of Davis-Standard thermoplastic and rubber extruders and wire insulating machinery.

Akron Chemical Co., 255 Fountain St., Akron, Ohio, is now handling the sales and service of **Hooker Electrochemical Co.'s Durez Plastics Div.'s** phenolic resins for the rubber industry in Ohio, Indiana, Michigan, western Pennsylvania, and western New York. Akron Chemical maintains a technical service laboratory and warehouse facilities at Akron and has represented Hooker in the sale of chemicals to the rubber industry for many years.

The Society of Plastics Engineers' scholarship of $200 for attendance at Lowell Technological Institute, Lowell, Mass., has been awarded to **Brooke Anderson**, North Chelmsford, Mass.

Norman E. Hathaway, formerly general sales manager, elected director and vice president—marketing of **Oronite Chemical Co.** to succeed **Milton L. Baker**, retired. With headquarters at the firm's home office, 200 Bush St., San Francisco, Calif., Mr. Hathaway will direct all marketing of Oronite's chemical products through company sales offices in the United States and overseas.

Donald A. Bender, with the firm since 1950, elected vice president of **The Carwin Co.**, North Haven, Conn. Mr. Bender's duties will be broadened to include responsibilty for the operations of the Chemical Div. and he will also continue as corporate secretary.

Capt. Charles E. Trescott, U.S.N. (ret.), appointed manufacturing manager of **Zenith Plastics Co.**, Gardena, Calif., a subsidiary of **Minnesota Mining & Mfg. Co.**, St. Paul, Minn. He will be responsible for all manufacturing departments, including tooling and production.

V. M. Stilson appointed vice president and general manager of the Molded Products Div. of **Admiral Corp.**, W. Chicago, Ill., producer of radio and phonograph cabinets, sterile disposable syringes, and a variety of plastics products for other companies. Mr. Stilson was formerly sales engineer and manager of molded plastics for Richardson Co. from 1937 to 1952, and left the post of manager of sales and engineering for Erie Resistor Corp. to join Admiral.

John P. Powell named vice president-general manager of **American Vulcanthene Div., The Nalge Co., Inc.**, Rochester, N. Y. The division specializes in corrosion and acid-resistant polyethylene pipe fittings and accessories for the process and plumbing industries.

John R. Garner named plant engineer of **H & R Industries**, Nazareth, Pa., producer of plastics film, sheet, moldings, and extrusions.

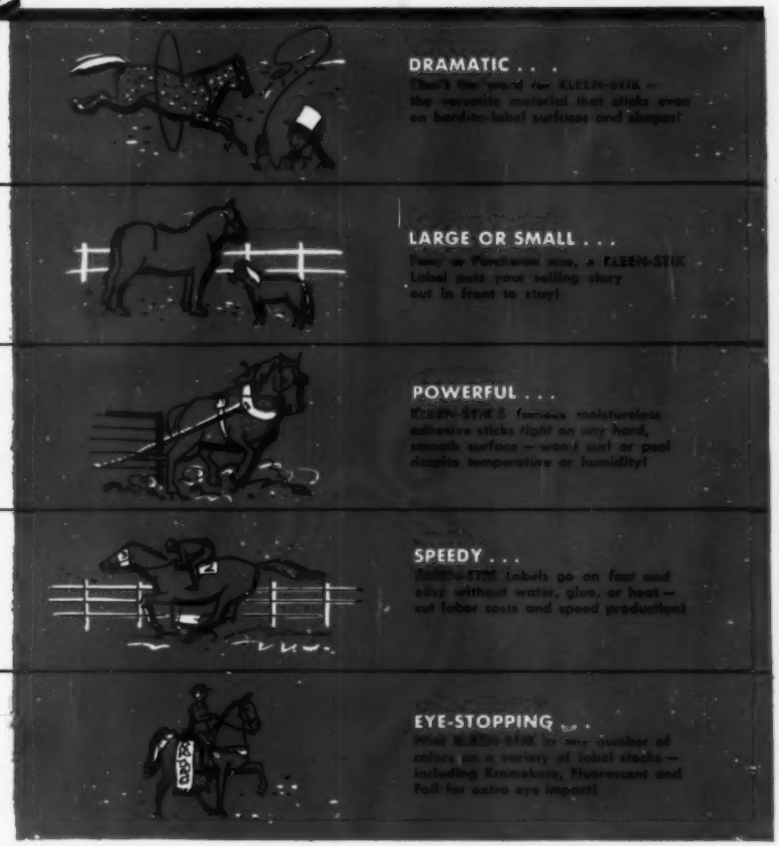
Kenneth A. Mack appointed vice president in charge of the Chemical Machinery Div. of **Baker Perkins, Inc.**, Saginaw, Mich. His new post embraces both sales and engineering. He will also retain his position as sales manager of the division. In ad-



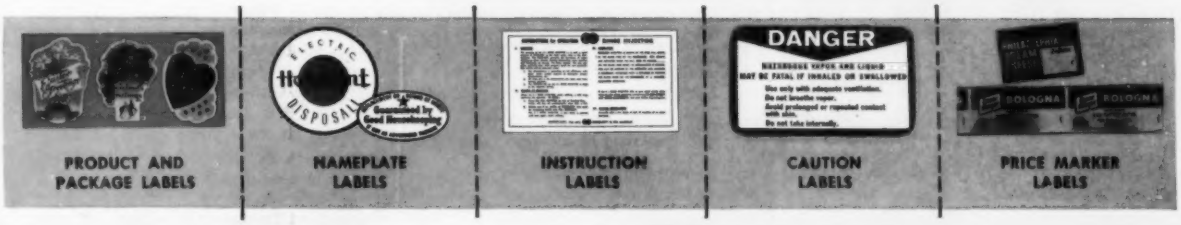
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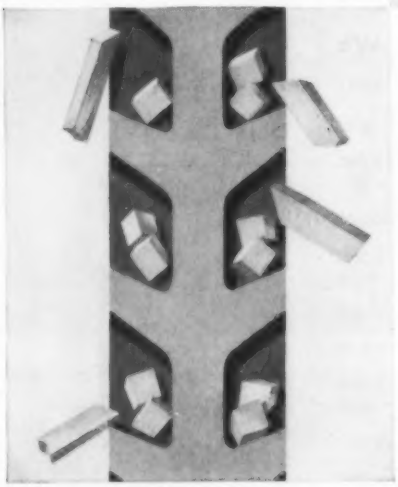


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dition to the equipment for the chemical process industries, the firm is the principal supplier of ovens and machinery to the nation's large production bakeries.

James R. Strother has joined **Flexonics Corp.**, Maywood, Ill., as assistant sales manager for industrial hose products. He will head up the firm's national sales program for plastic hose, metal, and synthetic rubber products to manufacturers of original equipment in the agricultural, construction, and general industrial fields.

Dr. W. F. Tuley, formerly supervisor of rubber chemical and synthetic rubber research, appointed to the new post of group manager of chemical development for **Naugatuck Chemical Div., U. S. Rubber Co.** Dr. Tuley will coordinate research and development on agricultural chemicals, rubber chemicals, heavy chemicals, chemical intermediates, and chemicals used in plastics.

Arnold M. Varner, formerly with General Electric Co.'s thermoplastics operation in Louisville, Ky., now plant superintendent of **Capac Industries, Inc.**, Capac, Mich.

James R. Caldwell, formerly chief research engineer for Century Engineers, Inc., now technical director of **Resin Formulators, Inc.**, 8956 National Blvd., Los Angeles, Calif., responsible for all research, development, and production. The company manufactures formulated epoxy resins.

Morton S. Schneider, formerly advertising and sales promotion manager of Dayton Rubber Co., appointed sales promotion manager of **Ideal Toy Corp.**, 200 Fifth Ave., New York 10, N. Y.

John R. Russell, formerly research chemist for Firestone Tire & Rubber Co., now manager of research and development of **Steere Enterprises, Inc.**, Akron, Ohio. The firm is engaged in plastics dip coating.

Fred Brombacher has joined **John Dusenbery Co., Inc.**, Verona, N. J., as head of technical sales and service for a new line of all-purpose laminating equipment. For the past 25 years, he was plant superintendent of Keller Dorian and the Laminating Div. of Cochran Foil Co.

Gordon E. Chase appointed district sales manager of **Manco Products, Inc.**, Melvindale, Mich., manufacturer of mold and die components used in molding plastics and other materials. Mr. Chase will make his

headquarters at 477 Stockbridge Ave., Buffalo, N. Y., and will cover Ohio, Indiana, New York, and western Pennsylvania.

Fred Y. Walters, Jr. named manager of **F. J. Stokes Co. of Canada, Ltd.**, 27 Wellington St., E., Toronto, Ont., a subsidiary of **F. J. Stokes Corp.**, Philadelphia, Pa.

George Kohlbacher appointed sales representative of industrial resins for the Thermosetting Div. of **Catalin Corp. of America** at its midwest sales office in Calumet City, Ill. He will represent Catalin in sales of phenolic, urea, cresylic, melamine, and resorcinol industrial resins.

Theodore P. Malinowski, named an assistant director of product development in **Atlas Powder Co.'s Chemicals Div.**, will head up the exploratory field development and marketing research sections. He was formerly development manager in the Product Development Dept.

John P. Baker has joined **Buckeye Molding Co.**, Miamisburg, Ohio, as comptroller and assistant manager. Mr. Baker was formerly affiliated with Plastene Corp., Crawfordsville, Ind., where he became resident manager and treasurer; prior to his association with Plastene, he was credit manager of Firestone Tire & Rubber Co., Marion, Ind.

Dow Chemical International, Ltd., an export subsidiary of **The Dow Chemical Co.**, opened a sales office in Hong Kong. **Eric C. Huggins**, formerly Far Eastern plastics sales manager at the Tokyo, Japan, sales office, appointed manager of the new office. **Howard C. Visger** named manager of the Tokyo office to succeed the late **H. Lee Clack.**

Shawinigan Resins Corp.: W. H. Bromley appointed director of marketing, succeeding **A. W. Dunning** who has resigned. **E. H. Finsilver** replaces Mr. Bromley as general sales manager. Mr. Bromley will be responsible for the firm's marketing functions, including sales, technical service, product development, market research, and advertising. Mr. Finsilver assumes responsibility for all field sales operations.

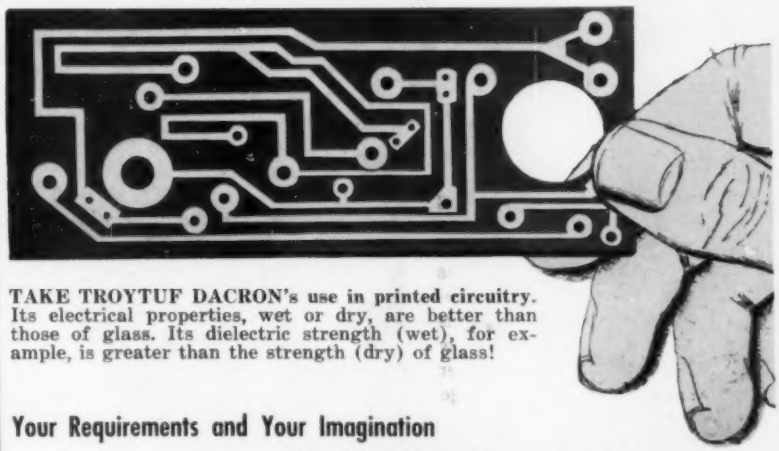
Midland Industries, Ltd., Toronto, Ont.: **L. E. "Lin" Love,** previously sales manager, industrial molding, named general sales manager, plastics. He will now direct the expanding operations of the Industrial Molding Div. and the sales program of the firm's proprietary plastics items. **Stan Manchester,** 28 years with the Sales Div. of **Percy Hermant Plastics,** which was acquired by Midland last September, continues as sales manager of the Proprietary Products Div.

Midland is now completing a

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TAKE TROYTUF DACRON's use in printed circuitry. Its electrical properties, wet or dry, are better than those of glass. Its dielectric strength (wet), for example, is greater than the strength (dry) of glass!

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TROYTUF DACRON and ORLON BLANKETS are extra-tough, light-weight reinforcing materials, specially suited to molding and laminating. They differ from most reinforcing media in that the fibres are tightly interlocked into easily-handled blanket form by a novel needle-punching operation.

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43,000-sq. ft. factory in Midland, Ont., which will house the company's entire plastics operations, including the transfer of the Hermant unit from Toronto.

John H. Karrh appointed to the newly created post of managing director of **Reeves Plastics, Inc., Div. of Reeves Brothers, Inc.**, 54 Worth St., New York 13, N. Y. He was formerly general manager of the Fiber Div. of Virginia-Carolina Chemical Corp., Richmond, Va.

John M. Feeley, previously in charge of sales in the New England area, named sales manager of **Dixon Corp.**, Bristol, R. I. He will be concerned with nationwide sales of the firm's products, including Teflon and Rulon. The latter is a bearing material developed by Dixon for use in applications where it is desirable or necessary to eliminate all need for lubrication.

Devoe & Raynolds Co., Inc., Div. of Merritt-Chapman & Scott Corp.: Doran S. Weinstein, executive vice president and general manager since 1954, elected president. He succeeds **Carl McFarlin, Sr.,** who since 1956 has been serving as chief executive officer of Devoe in addition to a post as president of **Tennessee Products & Chemical Corp.,** Nashville, Tenn., also a M-C&S subsidiary. Devoe produces paints, industrial finishes, and related products, including resins, chemicals, and plastic materials for coating manufacturers and other industries.

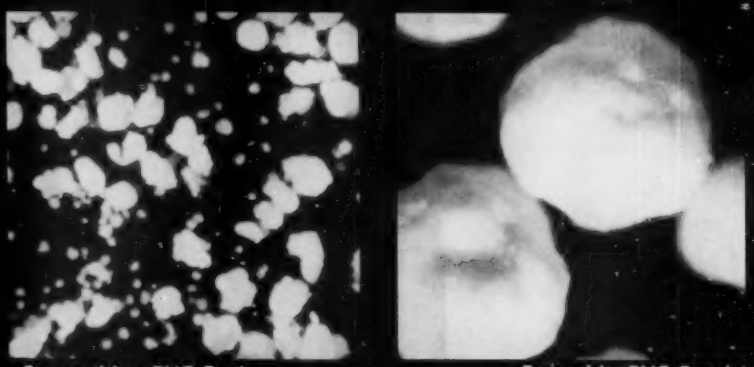
Yun Jen, formerly supervising chemist of American Cyanamid Co., named specialist in **General Electric Co.**'s Chemical Materials Dept. product development section, Anaheim, Calif. Mr. Jen has had more than six years of experience in polymer and plastics research and has been granted seven U. S. patents.

Jack Arnold, Jr. now manager of the Boston office of **Enjay Co., Inc.,** responsible for sales and other activities in the New England area. The firm markets petrochemicals.

James P. Gibbons named sales manager of **Industrial and Decorative Fiber Glass Fabric Div., Joseph M. P. Ott Mfg. Co., Inc.,** 87 Sabin St., Pawtucket, R. I. He will be responsible for product development, sale, and technical service of all fibrous glass fabrics.

Robert H. Wenzel appointed manager of the **Electrophysical Engineering Div. of National Automotive Fibres, Inc.** The division, which was recently acquired by the company,

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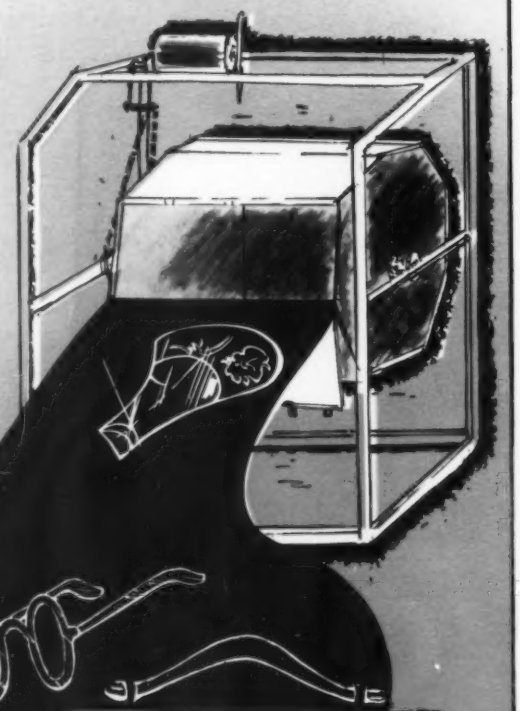
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will be relocated from Los Angeles to Orange, Calif. Mr. Wenzel is the founder and former owner of Electrophysical Engineering Co., manufacturer of plastic extrusion machinery. In recent years, he has reduced to practice and marketed low-frequency induction heated thermoplastic extruders on which he has applied for patents.

Professor L. Reed Brantley, head of the department of chemistry at **Occidental College,** has been elected 1958 chairman of the American Chemical Society's Division of Paint, Plastics and Printing Ink Chemistry. He succeeds **J. Kenneth Carver** of the Dayton, Ohio, Central Research Laboratory of Monsanto Chemical Co.

Corrections

"Factors affecting plastisol flow," by *H. E. Frey,* Dec., p. 164: Caption for Fig. 7 should read as follows: "Effect of diluents. Compound (parts by weight): Geon resin 121—100, DOP —50, solvent—10."

The source of three charts appearing in the January issue was inadvertently omitted. The chart on p. 90, entitled *"Estimated U. S. custom molding market—1956,"* is to be credited to **Arthur D. Little, Inc.**; the chart on p. 94, entitled *"Make-up of the U. S. plastics industry by processes,"* and the chart on p. 105 entitled *"Location of custom plastics molding industry,"* appeared by courtesy of **Tarnell Co., Inc.** All three of these charts were used by **Philip Singleton,** president of **Prolon Div., Pro-Phy-lac-tic Brush Co.,** in a recent address before the New England Section of the S.P.I.

"World trade in plastics," by *Erich Gansmuller* and *Robert W. Crawford,* Oct. 1957: French producers of polyethylene listed on p. 105 included Compagnie Française de Raffinage, Société Kuhlmann, and Société des Usines Chimiques Rhône-Poulenc. These three companies are not producers, but jointly formed Manufacture Normande de Polyéthylènes, which manufactures polyethylene by the Phillips process.

On p. 107, Société Lorraine-Kuhlmann, a joint enterprise of Houillères de Lorraine and Ets. Kuhlmann, should have been listed as a producer of polystyrene.

On p. 237, Argentina was included among countries where imports of American plastics are restricted by license regulations or quota systems. We are informed that plastics raw materials, with the exception of phenolics and urea, are freelisted and can be imported from any source without import license or other formalities.

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FOR SALE: Wheelabrator 20x27".—Injection Presses: Stokes Automatic 4 oz. Jackson-Church 64 oz. HPM 60 oz. to 4 oz. size. Reeds: 22, 16, 12 & 8 oz. Lester 8 & 12 oz. Watson 28 oz., 12 oz. Lewis 4 oz. Moslo 2½ oz. Van Dorn 1 oz.—Extruders: 3½" oil htd. NRM w. crosshead. 30" Sheet Die w. 52" Pull-Off. Dulmage Meterpump 28". Despatch PLHD 6 & 10 draw. Ovens. Cumberland mod 0 & 10 grinders. 2 HP boilers.—Apex 2 col. Container Imprint mach.—Compression Presses various sizes. Elmes Hydrolairpress 30 T. Preformpresses Colton 5½ T & Stokes 280 G.—Baker-Perkins 200 gal. mixer. 42 cft. Ribbon mixer. Vacuum Form machines 30x30", 40x60". Dake 200 T. Press—List your surplus equipment with me. Wanted: Stokes Standards 50 to 150 T. Extruders 1½" to 4½" Defiance 20 Preformpress.—All midwest locations! Justin Zenner, 823 Waveland Ave., Chicago 13, Ill.

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LIQUIDATION SALE MOLDING PLANT: 1—300 Ton Erie Compression Press; 2—375 Ton French Oil Compression; 2—170 Ton Transfer Molding Presses; 2—100 Ton Transfer Molding presses; 1—No. 3 DT Colton Tablet Machine; 1—No. 5½ T Colton Preform Machine. Also Air Compressors, Pre Heaters and miscellaneous shop equipment. Reply Box 3220, Modern Plastics.

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(Continued on page 272)



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(Continued from page 270)

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Materials wanted

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WANTED: Plastic of all kinds—virgin, reground, lumps sheet & reject parts. Highest prices paid for styrene, polyethylene, acetate, nylon, vinyl etc. We can also supply virgin & reground materials at tremendous savings. Address inquiries to: Gold-Mark Plastic Compounds, Inc. 4-05 26th Ave., Long Island City 2, N. Y., RAvenswood 1-0880.

WANTED: High Impact Styrene, mixed color regrounds Styrex 767. Clear regrounds. Reply to molder, Box 3212, Modern Plastics.

MOLDERS: We can use any clean reground Polystyrene. High impact—Acetate and Butyrate—also light mottled material. Vacuum sheet stock also acceptable. Submit samples and price wanted. Contact: Brown & Shipley Corporation, 963 Newark Avenue, Elizabeth, New Jersey.

PLASTIC SCRAP: Get top money—Now paying top prices for all thermoplastic scrap. Wanted: polystrene, cellulose acetate, vinyl, polyethylene, butyrate, acrylic, nylon. All types and forms including rejects and obsolete molding powders. Fast action wherever you are located. Write, wire today. Gering Products, Inc., Kenilworth, N. J.—New Jersey. Bridge 6-2900—New York: Cortland 7-3583.

WANTED:
Plastics Scrap and Rejects of all kinds. Ground and unground. Also rejected molded pieces and surplus virgin molding powders. Top prices paid. Reply Box 3217, Modern Plastics.

WANTED: Clear crystal & transparent colors in acetate scrap. Ground clean & in fibers. Also surplus molding powders. Top price paid by end user. MArket 2-8132, Newark, N. J.

WANTED:
Vinyl, polyethylene and styrene scrap for our manufacture of molding and extrusion compounds. We can use rigid from vacuum forming, lumps, bleeder, slabs, trimmings, rejects—anything suitable for reprocessing. Send samples and details or telephone. Steady buyers since 1940. Rotex Rubber Company, Inc., 1-23 Jabez Street, Newark 5, N. J. MArket 4-4444.

Molds for sale

FOR SALE: Houseware molds, comb molds, also some novelty and specialty items. All in excellent condition. No reasonable offer refused. Send for list. Reply Box 3219, Modern Plastics.

Molds wanted

WANTED: Injection molds—one item or complete line of proprietary consumer articles, also interested in molds for industrial parts such as knobs, handles, fasteners, boxes, etc. Will consider purchasing complete injection plant with end products or parts line. Designers: New items wanted—cash or royalty. Victory Mfg. Company, 1722 West Arcade Place, Chicago 12, Ill.—Estab. 1930.

Help wanted

INJECTION MOLDING SUPERVISOR: Good opportunity for experienced man in new injection molding plant in metropolitan New York. Must be thoroughly familiar with setting up molds, running and minor maintenance of machines. Reply Box 3224, Modern Plastics.

SALESMAN: Who has ability to earn upwards of $15,000 per year, is sought by well established injection molder and finisher in New York City area. Prefer experienced mature salesman with engineering, estimating, mold making, painting, assembling background, who can help industrial and consumer customers develop new volume products. We do design and engineering and offer 100% factory support. Reply held in strict confidence. Box MP 433, 125 W. 41 St., New York 36.

SALESMAN: Material Supplier needs salesman 25-30 years of age with compression molding experience. Must have sales personality. Locate within 50 miles New York. Reply Box 3211, Modern Plastics.

HELP WANTED: On or before February 1, 1958 we need: A mechanical engineer who likes machine design work; A chemical engineer who has experience in resin manufacture or application, or who is interested in those fields; A ceramic engineer who knows something about glass and would like to work with glass fibers. The positions are in the combined research and development division of Nicolet Industries, Inc. (miners of asbestos fibers and manufacturers of asbestos papers and boards) and Modiglass Fibers, Inc. (manufacturers of glass fibers and glass fiber mats) which will be located in facilities now being constructed at Florham Park, N. J. (near Morristown). A relatively small staff of research personnel working in a very well equipped laboratory and pilot plant means that each individual will enjoy variety in his work and will have ample opportunity to assume responsibility and exercise his imagination. Remuneration: Starting salary is at a level to attract men now earning about $6,000-$7,000, and a profit sharing plan provides an opportunity to earn additional amounts. Inquiries invited, in confidence, to Mr. E. T. Duke, Director of Product Development, Nicolet Industries, Inc., 70 Pine Street, New York 5, New York. All letters will be acknowledged.

PROJECT MANAGER:—Plastics. Opportunity with a future. Well established and progressive Michigan manufacturer in non-ferrous industry. Prefer a graduate engineer with administrative and creative ability in this field. Responsible for direction and coordination of company's Plastics program. Enlargement of Plastics manufacturing, sales and development activities. Experience desired in Plastics research, product applications and manufacturing. Age preferably under 40. Applicant should have initiative and growth potential for further advancement. Salary commensurate with job requirements and applicant's qualifications. Give complete statement of experience and qualifications. Replies confidential. Reply Box 3223, Modern Plastics.

GENERAL FOREMAN: Vinyl Calendering. Opening exists for topnotch general foreman thoroughly experienced in calendering all types supported and unsupported vinyl sheeting. Important position with excellent future. Please submit resume. Reply Box 3202, Modern Plastics.

(Continued on page 274)



South block of Grosvenor House, London.

Furnishing at Grosvenor House with

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Bartrev Particle Board played an important part in the furnishing of the new 92 bedroom extension at Grosvenor House, London, which was completed in November, 1957. The carcasses of the fitted wardrobes and dressing tables were made from Bartrev by Gordon Russell Ltd., Broadway, Worcestershire. Bartrev, supplied 4′ wide in any length, has a wide variety of uses in building and cabinet making.
International Plastics Ltd., 3 Vere Street, London, W.1, England.

Furniture designed by R. D. Russell & Partners.



(*Continued from page 272*)

FABRICATION SUPT.: Progressive New England manufacturer, Northeast location, seeks top notch thermoplastic sheet fabricator with heavy experience in acrylics as Supt. of a rapidly expanding Fabrication Division. Full experience in tooling and equipment as well as managerial skills essential. Send detailed resume with references and salary requirements to Box 3203, Modern Plastics.

PACKAGING SPECIALIST: Salaried position now exists for a packaging specialist in our Development Division for the development and evaluation of films and laminations. A technical degree is required with a minimum of two years experience in this field. Permanent location in Akron, Ohio. Liberal company benefits including company paid hospitalization, pension and life insurance plans. Reply should give details of education, work experience, and should include salary required. W. F. Catron, Technical Personnel, Goodyear Tire & Rubber Co., 1144 E. Market St., Akron 16, Ohio.

ENGINEER: For industrial paper and film converting company located in new plant in suburbs of midwestern city. Permanent position with a reliable growing concern. You will be in complete charge of machine design, building and maintenance. Diversification of product line insures interesting and challenging work. Good salary, profit sharing bonus and pension plan and stock purchase plan. Please send resume of your experience, education and personal history to Box 3210, Modern Plastics.

OPPORTUNITY: For Exp. Plant Manager. Maker of quality reinforced fiberglas structural panels has opening for experienced plant manager. A real producer will go places with our aggressive organization. Submit resume, with salary expected. East coast location. Reply Box 3207, Modern Plastics.

WANTED: Manufacturers representatives along Eastern U. S. to handle complete line of Epoxy resins for tooling and allied field. Also polyester resins. Reply Box 3201, Modern Plastics.

GENERAL FOREMAN: Finishing Department. Established Chicago area injection molder has immediate opening for top man in finishing department. Must be good organizer and capable of handling people. Unusual opportunity for growth with company that is expanding. Stock option and bonus plan. Reply in confidence giving experience and salary history. Reply Box 3216, Modern Plastics.

PERSONNEL: Executive—Technical—Sales—Production. Employers and Applicants—whatever your requirements, choose the Leader in Personnel Placement. Cadillac Associates, Inc., Clem Easly—Consultant to Plastics Industry, 220 South State, Chicago 4, Ill. —WAbash 2-4800. Call, write or wire—in confidence.

MANUFACTURER'S SALES REPRESENTATIVE WANTED: Established, growing Midwest Company manufacturing automatic plastic injection molding machines, seeking active representation in several choice areas in U. S. as well as Canada and Puerto Rico. Knowledge of injection molding desirable and association with plastic industry. Generous commission. Write fully giving territory covered, details of your organization, experience, lines presently carried, etc. Reply Box 3206, Modern Plastics.

MANUFACTURERS AGENT WANTED: A young, aggressive extruder of nylon tubing, rods and profiles has need of representation in several areas to complete national sales campaign. We offer excellent engineering service and experience; exclusive territories and contractual agreements. Please send resume of area covered, lines carried and background of your organization. Reply Box 3209, Modern Plastics.

EXTRUSION FOREMAN: Experienced in all phases of plastic extrusion particularly sheeting. Permanent position with excellent growth potential Detroit location. Furnish complete resume including salary. Reply Box 3205, Modern Plastics.

Situations wanted

ENGINEER: Age 50—Heavy experience in thermosetting plastics molding and finishing including automatic methods. Broad thermoplastic experience with styrene, acrylics, acetates, nylon, etc. Presently Mfg. Eng. Supv. with leading plastic molding company. Available in 30 days. Seek position as Plant Manager or Tool Superintendent. Prefer captive molder. Reply Box 3214, Modern Plastics.

VINYL FOAM CHEMIST-ENGINEER: Graduate degree in high polymers and plastics technology. Over 10 years experience in development and applications of plastics. Thorough know-how all phases of plastics foam industry. Engineering-Production-Sales liaison. Presently employed. Will relocate for responsible position in administration or research. Reply Box 3221, Modern Plastics.

Miscellaneous

FOR SALE: Complete operating plant manufacturing translucent fiberglas reinforced plastic building panels. Equipment includes fiberglas impregnating machine, two automatic ovens, trimming and mixing facilities. Production capacity 2,000 sq. ft. per shift with six employees. Write to: Dipcraft Mfg. Co., 4830 Hatfield Street, Pittsburgh 1, Pa.

PROBLEM (?): In plastic product design; in material selection; in process development. A new viewpoint backed with broad experience in the plastics field could provide the answer. Consult: Sidney Levy, 145 West Cuthbert Blvd., Audubon 6, N. J. Phone COllingswood 5-7726.

DISTRIBUTOR: Of Plastic Chemicals or Resin-Fiberglass Lines. Organic Peroxide manufacturer offering franchises in East, South and some Midwest areas for its catalysts and hardeners. Absolute necessity for sales organization calling on reinforced plastics field. Please state related lines carried, sales force and territory. Reply Box 3204, Modern Plastics.



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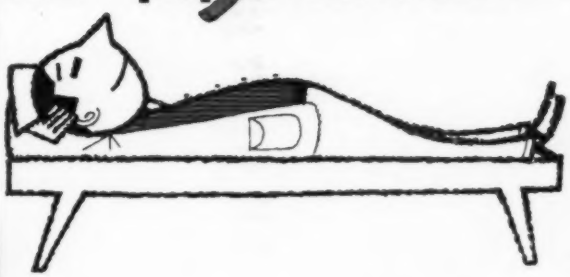
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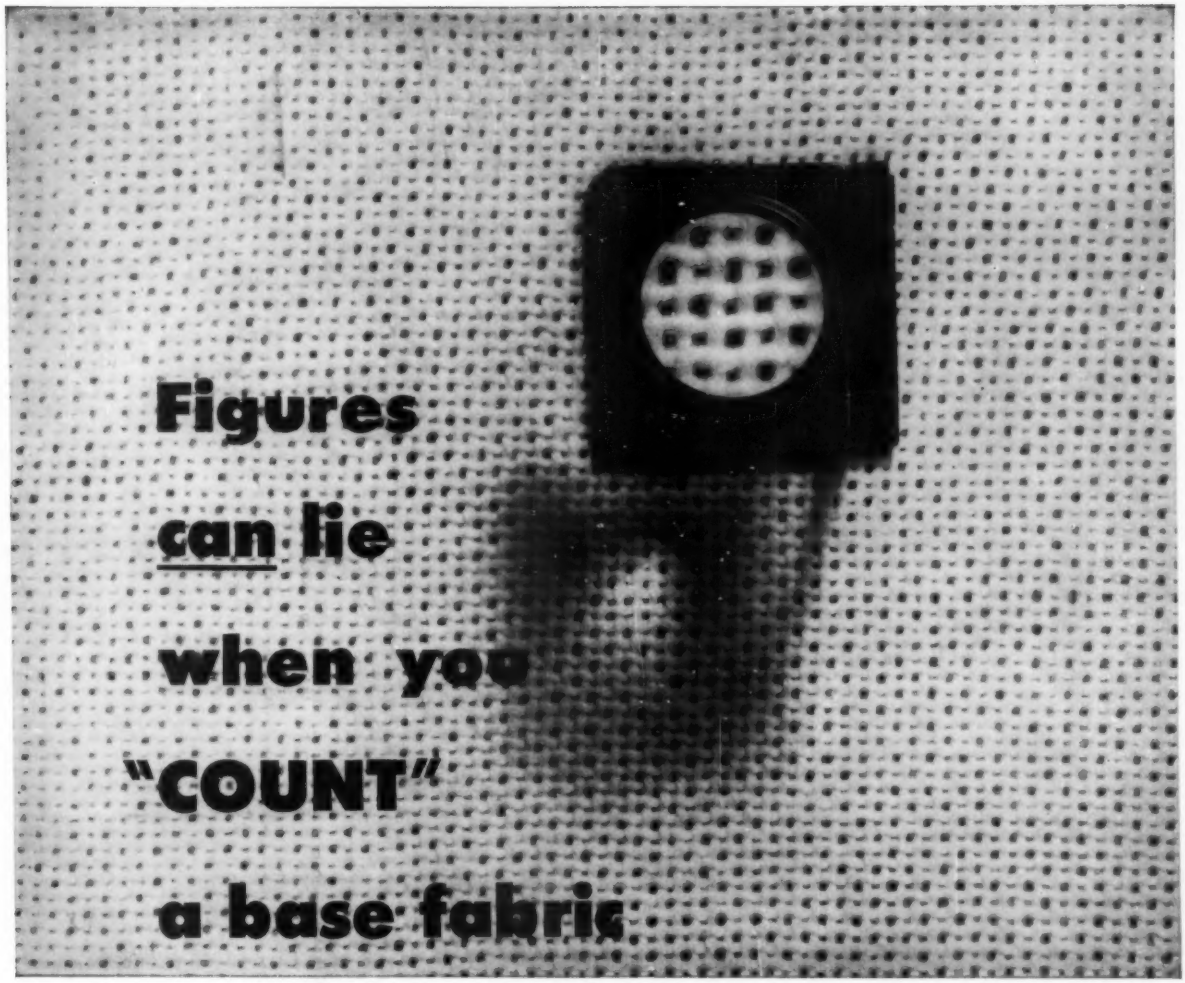
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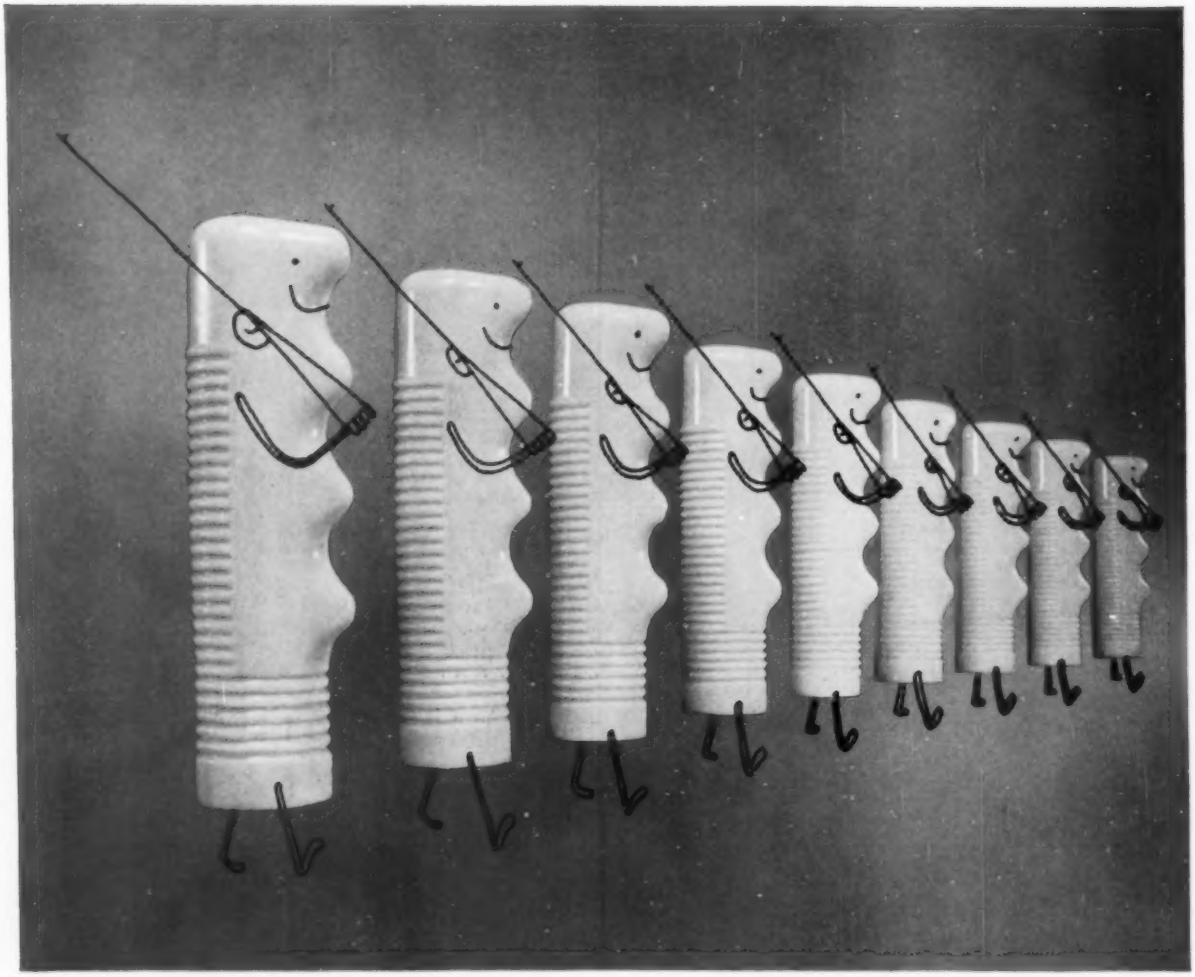
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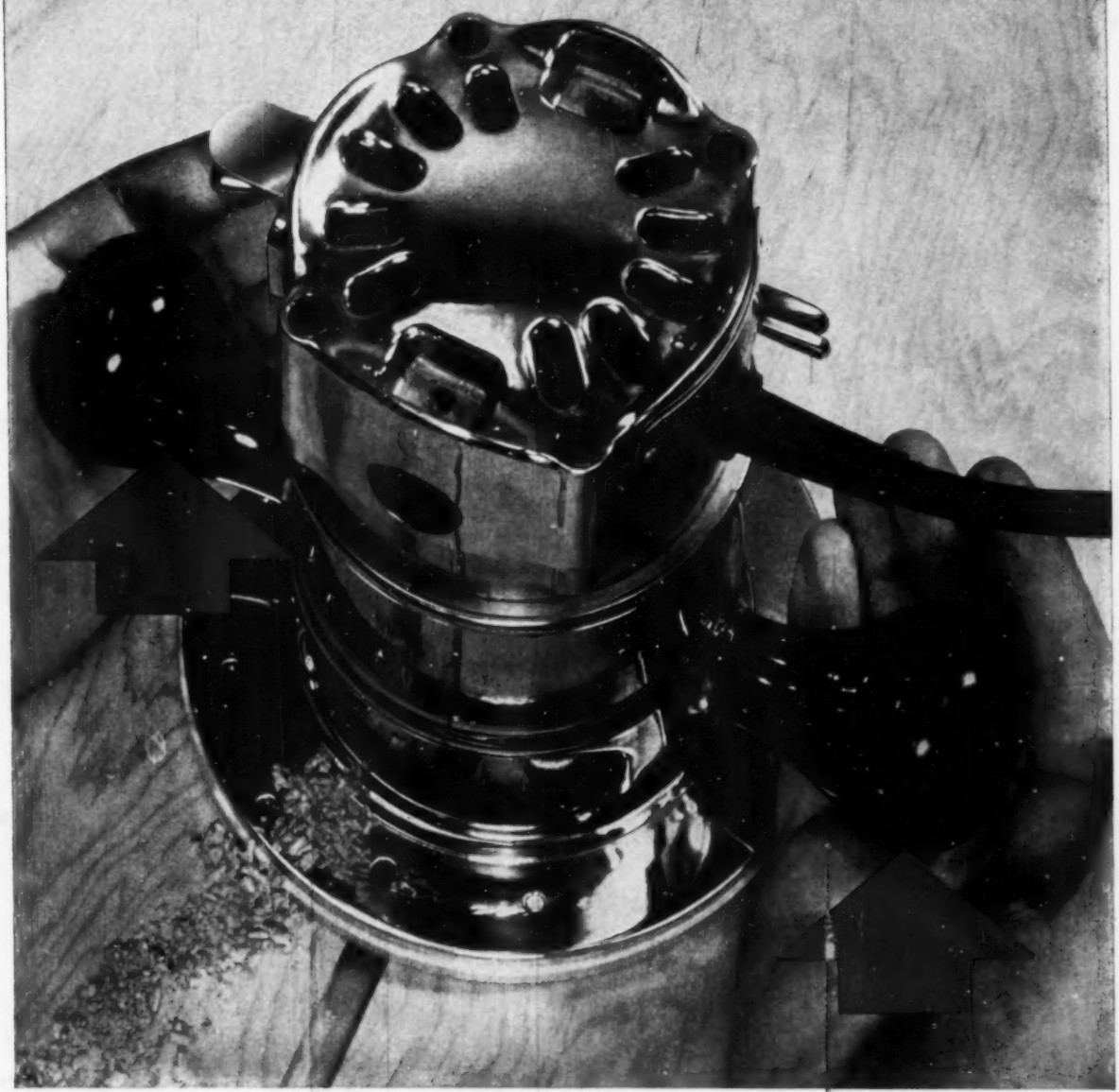
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HANDLES FOR BLACK & DECKER ROUTER MOLDED BY SHAW INSULATOR CO., FROM G-E 12920 PHENOLIC COMPOUND



TAKE A GOOD LOOK AT THE HANDLES

. . . here's why they're molded from a G-E Phenolic

"When you supply components to Black & Decker, you're on your mettle all the way," says S. H. Shaw, vice president of Shaw Insulator Co., Irvington, N. J. "When B&D gave us the job of molding the handles for their new Heavy-Duty Router, we knew that only the best would be good enough. They had to be light, strong and impervious to mars and scratches, even after long, hard use."

"Working closely with General Electric engineers, we perfected our molding technique, using *G-E 12920* to give us the required high finish and strength. This general-purpose compound cures fast for high production rates and has excellent flow properties. Another thing—we can use it for so many kinds of jobs that our inventory problems are simplified."

Many leading molders have found, like Mr. Shaw, that G-E phenolics are best for the high-specification jobs. But evaluate them for yourself—on molding characteristics and product performance. For information or technical assistance, write General Electric Company, Section MP 258, Chemical Materials Dept., Pittsfield, Mass.

Progress In Phenolics

GENERAL ELECTRIC